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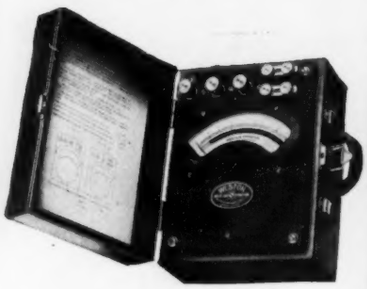

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Electrical World

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The New England Power Conference

LAST week a memorable conference upon power development in New England was held at Worcester. Under the chairmanship of Samuel Ferguson, more than 600 delegates from business and utility organizations heard Owen D. Young, Martin J. Insull and Dexter P. Cooper discuss the value of power pooling, of interconnection and of the engineering development of the electrical resources of the Northeast. Thus a new point of contact between power producers, distributors and users was found. The sound economic lessons set forth were broadcasted by press and radio and served effectively to explain to the public at large the meaning of active and important tendencies in electrical supply. Conceived in connection with a broad movement among state governors to unite New Englanders for the common good, the conference achieved a triumph in economic publicity and made no little headway against the doctrine of limiting power pooling by political barriers.

Although many engineers and utility men attended, the meeting avoided technicalities and was devoted to bringing about a better understanding of the economies of power supply and a closer alliance between the utilities and their customers. In this connection the pressing problem of electric service to farmers was briefly discussed, and Mr. Ferguson's recommendation that temporarily the city companies should bear the burdens of unprofitable rural extensions aroused much interest. Another session, devoted to agriculture, emphasized the growing importance of the farmer in the development of the state, and a third, on marketing, rounded out the program. Present indications are that conferences of this kind will be conducted in the future as a proved method of solving regional problems, and if this is done, the electrical industry, with its close connection with almost all branches of commerce and manufacture, will play an important part in the work. Such gatherings as this open the way toward group co-operation, long found of the utmost value within the electrical industry itself, and the men of the Northeast are to be congratulated upon so constructive a step in the field of mutual understanding and team play for the welfare of the New England States.

The Holiday Lighting Spirit All the Year Round

AGAIN we are approaching the period when artificial light is specially called upon to radiate the holiday spirit of good will, cheerfulness and hospitality. In the homes of this happy land many millions of miniature electric lamps will perform their delightful Christmas function. Hundreds of thousands of large colored lamps will broadcast their message from live trees in the dooryards. Many householders who have caught the full spirit of the season will light up their porches for the holidays. Stores, offices, interiors and exteriors of many kinds will also call in the help of electric light. The spirit of Christmas does not flourish amid dismal surroundings.

Is there not a lesson in this general illumination which may well be taught throughout the year? The advantages of good illumination are not confined to Christmas week, even though tradition leads to a special call upon them during this season. A well-lighted home, office, store or factory may radiate some of this Christmas spirit throughout the year. It will represent enlightenment, comfort, cheerfulness and high-scale living or working. The cost is small in comparison with the direct and indirect value of abounding light. A portable lamp brings as much to the home it enters at one time of the year as at another. Poorly lighted interiors can no more nourish enthusiasm and cheerfulness in February than they can during Christmas.

Wanted—A Dependable Business Barometer

A BAROMETER of business that would anticipate slumps and improvements or at least indicate fluctuations the instant they start would be invaluable. In the electrical industry the financial and production departments of both manufacturers and utilities would obviously be interested. Sales departments are equally although not so evidently concerned, engineering departments possibly less so. Various types of barometers have been developed and are in use with more or less success, but they all leave something to be desired.

"How about kilowatt-hours per working day per connected kilowatt or horsepower?" asks the head of one utility power sales department who is giving much study to the subject of finding a reliable barometer that will enable him to utilize his staff most efficiently. Without a guide of some sort organizations will periodically find themselves either overloaded with work or looking for something to do. Knowledge of whether a business change is for better or worse would permit the activities of a staff to be correspondingly adjusted. For example, slack periods are the time for utility sales departments to undertake promotional work requiring attention that cannot be given it during active periods —such as exhaustive reports to prospective customers on the economic benefits of using purchased power for this or that application. Such periods also provide an opportune time to discuss with customers, prospective or existing, the economy of electrical methods as a means of cutting costs, permitting lower selling prices and thus obtaining more business.

In times of prosperity the public is naturally more prone to spend money. Economies do not have to be discussed so much as ability to increase production. Salesmen must be relieved from the preparation of exhaustive reports and be available for consulting with and advising customers, who voluntarily seek service more extensively at such times. Well-founded knowl-

edge of approaching prosperity, if imparted to others before it becomes common knowledge, may be the means of increasing sales and hurrying along the prosperity. Similarly, signs of coming depressions, if tactfully used, will inspire efforts to combat conditions and make the slump of less magnitude or shorter duration.

In some ways the factor "kilowatt-hours per working day per connected kilowatt" (or "horsepower") has the merit of serving as such a barometer of business conditions. The actual values will not necessarily be significant, but fluctuations will. With normal conditions this factor will remain about the same from day to day except for weekly, monthly or seasonal variations. Once observed, the periodic variations can be accounted for, and other fluctuations must be interpreted as increased or reduced use of equipment—which is a measure of activity. Of course, this factor may change as industry becomes educated to the advantages of electricity, but change due to this cause will usually be apparent. Considered in any territory, this factor may serve as a general barometer for industry as a whole. Segregated by industry or individual installation, the factor would facilitate interesting analyses of each.

Should a Power Company Sell Appliances?

IN THE last five years central-station companies have been confronted with a vital sales problem. To sell or not to sell was the question. On the other hand there were those who urged that the power companies should retire from merchandising and leave a clear field for the electrical and other dealers, while others felt that the utilities should resume appliance selling in order that new devices might be properly pioneered, that a merchandising standard might be set up and that there might be at least one reliable and permanent place where electrical appliances would be serviced. Not every company, fortunately, followed the advice implicitly in either case, and there is still some difference of opinion; but all recognize the necessity for getting more load on their lines, and one sure way of doing it is to sell energy-consuming devices to residential customers. A number of large companies which abandoned merchandising during and immediately following the war have resumed their operations on a larger scale than previously. Others which in former years never sold any appliances have organized extensive sales departments to increase domestic consumption.

One of the most conspicuous of the latter is the Oklahoma Gas & Electric Company, which in four months' operation has built up an appliance sales volume equivalent to one dollar per month per customer and at the same time exploded the idea that central-station merchandising is detrimental to the electrical dealer. As a matter of fact, dealers' sales have actually increased wherever the company has opened an appliance store in Oklahoma. This achievement as well as data collected in other localities shows that where the power company consistently goes about its business of supplying customers with adequate electrical equipment there will be considerably more appliance business for electrical and other dealers than where the central-station company is content to permit control of this important source of revenue to drift into the hands of those who care little about the quality of the goods they sell and still less about the interests of the customer or the utility. The central-station industry in its need for more revenue per customer can ill afford to experiment with indifferent outside agencies for increasing its business.

Subterranean Heat Possibilities

ENGINEERS are daring to tap the heat resources in the interior of the earth, and at a meeting in New York last week they even discussed the possibilities of harnessing volcanoes to turbines. In Sonoma County, California, a power plant is to be installed in the near future which will use steam from the earth; at Larderello, in Italy, there is in operation a geyser power plant of 7,500 kw. capacity, and in Japan, in Alaska and in many other geyser regions there are remarkable possibilities for obtaining power from subterranean heat.

In the present state of development there is not much chance that any large amounts of power will come from the earth. However, it is indeed reassuring to find that there is a large energy reserve in the interior of the earth which can be tapped when expedient. As expressed by F. A. Perret at the New York meeting, Mother Earth is "listening in" and saying: "It is impossible that a world which has given birth to a race of men should not contain within itself everything which can possibly be needed for their welfare. Here are heat and light and power in superabundance, but you must come and take them. Shades of Pluto! my children, bring on your engineers."

The Promising Position of the Electrical Manufacturer

MANUFACTURERS of the electrical industry face a future of almost unparalleled opportunity. That is apparent to all men who are familiar with electrical progress over the past twenty years and have thought forward along the drift of the expanding popularity of electric service. In industry, agriculture, transportation and in the home there is active, insistent and increasing demand for a larger utilization of electric power, heat and light, and the development of the art and the plant equipment has reached a point where the executive thought that has been so continuously absorbed in preparation is now inclining more and more toward market building as the great objective. The entire electrical industry that for so long has occupied itself with breaking ground and planting seed and nourishing its crop is now approaching the season of the harvest.

How clearly this trend is observable in the manufacturing field, as indexed by the increasing use of power per worker, was vividly portrayed by Gerard Swope, president of the General Electric Company, in an address at the annual banquet of the Associated Manufacturers of Electrical Supplies last week, in statistics from the Schenectady works of that company, where 22,000 employees are engaged in the shops. Between the years 1912 and 1924, he said, wages there increased 100 per cent and the cost of living 60 per cent, thus showing a net gain to the workers of 40 per cent in improved prosperity. But it actually meant far more than that in actual prosperity; for in 1912 the average weekly wage was $20 and the average weekly cost of subsistence $18, leaving the worker a bare margin of

$2, whereas in 1924 the weekly wage had risen to $40 and the cost of living to $28.80, leaving a balance of $11.20 over subsistence. Meanwhile there was a growth of 15 per cent in the number of workers, and to meet these higher costs 100 per cent more power per worker was introduced into the manufacturing processes with the result that production was increased by 172 per cent.

These benefits were gained, of course, under the same economic pressure that besets and is inspiring every other manufacturer of every line. The record is but typical of the part which electric power is playing in the reorganization of industry to overcome the burden of cost left by the war, and the same forces are no less operative in the other fields.

Mr. Swope also cited some extremely interesting and hitherto unpublished figures on the present prosperity of the electrical manufacturing industry. A study of the published income-tax returns of 111 of the most prominent electrical manufacturers, doing an aggregate annual business of $759,000,000, shows, he said, a net profit of 16.6 per cent. Surely this indicates a sound over-all basis of good health that gives bright promise of the future, when the spirit of the market is taken into consideration. Some companies undoubtedly are less prosperous than others. But the opportunity is accessible to all and the measure of prosperity which each manufacturer—each man—will enjoy will be the product of his own effectiveness, as it has been throughout all generations.

Executives and Public Relations

INVESTIGATION by a number of central-station companies to determine the status of their public relations has revealed that comparatively few people are hostile to the utilities. A big majority—95 per cent of the customers of one company—are satisfied with existing rates, service and so on and are classified as mildly favorable or neutral. Some are even enthusiastic supporters of their utilities. Thus, if there ever was hostility toward electric public utilities in general, it would appear that the public attitude toward them has changed from a state of passive resistance to one of favorable neutrality bordering on friendliness. This is an accomplishment, and utility executives are to be commended for their determination to employ every legitimate means of making still closer friends of the public.

A study of the factors which determine the varying degrees of warmth displayed in the attitude of customers has led to the conclusion that they are made up chiefly of two components—employee performance and service. Taking good service for granted, any deficiency, it is believed, can be attributed to failure of the human element. Broadly speaking, this is because employees are the points of contact between the company and the customers, but an important element not always recognized is the attitude and personality of the head of the company. It is in the executive office that a company's public relations are molded, not by general orders outlining a code of service and behavior for employees, but by the example which the president or general manager himself sets. An executive who has not a zeal for service need not be surprised if his organization takes his attitude as its cue in dealing with the customers of the company. Public good will can hardly be promoted in that way.

Electrically Welded Pipe for Long Pipe Line

ELECTRICALLY welded pipe is to have an opportunity to prove its worth in connection with the Mokelumne water-supply project of the city of Oakland, Cal., contracts for which were recently awarded. As stated in our "Briefer News" columns, the pipe line on this project will be 85 miles in length with diameters from 60 in. to 65 in. and metal thicknesses varying from $\frac{3}{8}$ in. to $\frac{5}{8}$ in. The contract was awarded to the bidder on electrically welded pipe in consideration of a four-million-dollar saving over riveted steel and ample guarantees as to the strength of the welds. If the pipe fails to meet certain specified shop tests, the contractor will be permitted to substitute riveted steel pipe at an increase in price of 40 per cent.

With such a differential in favor of electrically welded pipe it is to be hoped that the welds will prove equal if not superior to other methods of manufacture. It is not to be overlooked, however, that to butt-weld steel plates electrically of thicknesses such as these on a scale so large is untried. Doubters will recall that the experience of users of forge-welded penstock on the Pacific Coast during the past few years has led to some question as to the strength of the metal at the welds, and in one recent case there was an indication that the metal at the weld had not completely fused, no doubt owing to insufficient heating or a change in the structure of the metal caused by rapid local heating. It is possible that certain processes of electric welding may be subject to the same drawbacks. None the less, the Oakland proposal presents a challenge, and it will be highly interesting to see whether the electric welding art has progressed to the point where electric welds in thick plates are as dependable and durable as other methods of joining the plates. An affirmative answer will be one more triumph for electricity.

Network Stability Next in Order

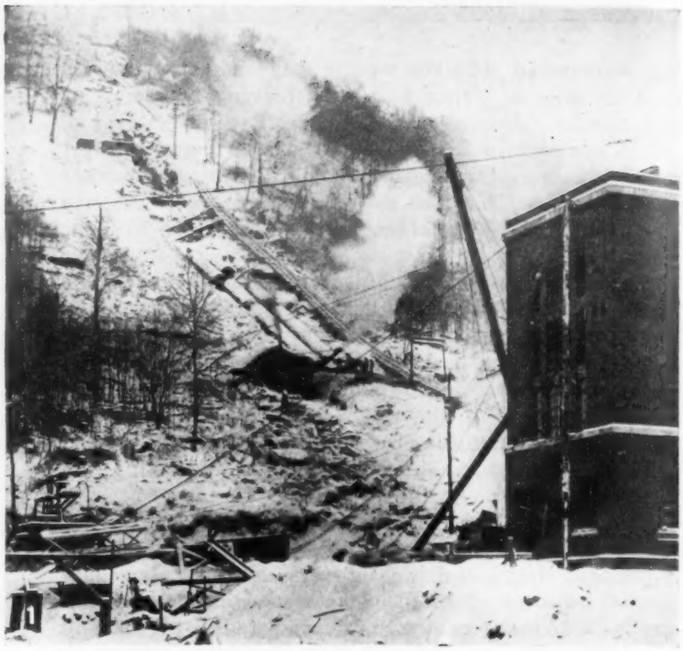
THE stability problem for single long-distance high-tension lines and for low-voltage metropolitan areas has been attacked with encouraging results. But the network long-distance transmission system offers a problem in stability which still needs solution and which offers some baffling aspects to transmission engineers. Like most network problems, it is inherently difficult of solution because of the many elements that need to be considered. In addition to the normal electrical network quantities, however, a large interlinked system of high-tension lines presents many intangible or unknown factors. Lightning in many regions is the chief cause of surges and interruptions to service and has a decided bearing on the stability condition. The practical limitations of relaying and switching must be considered, and there are many permanent and transient stability conditions to be evaluated.

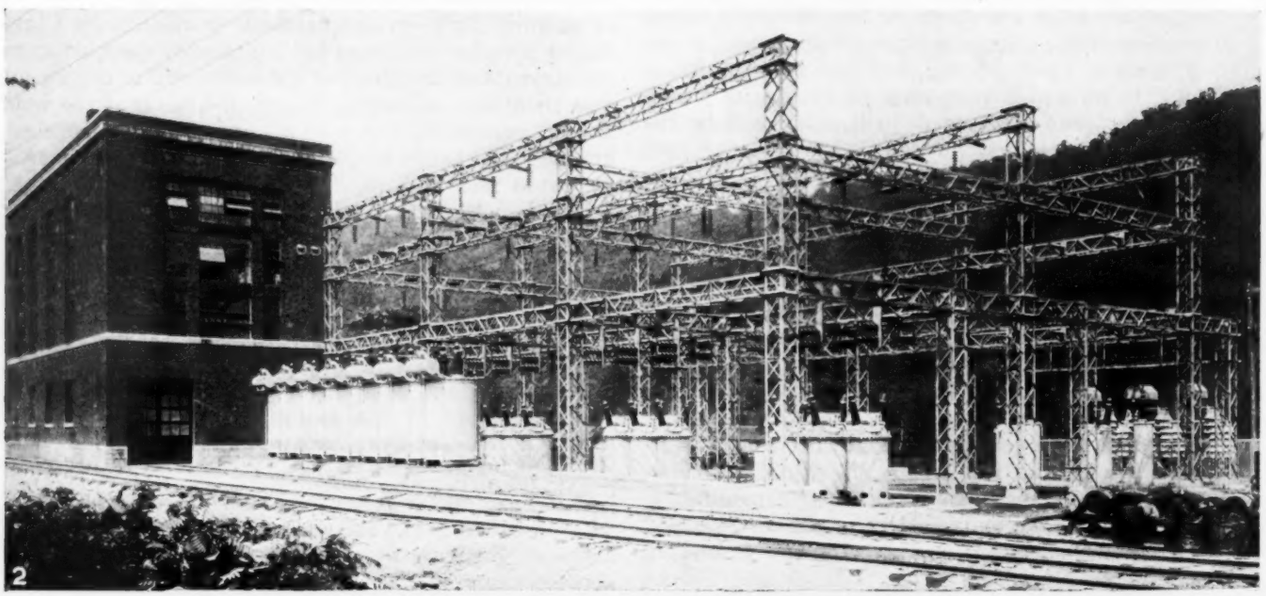
Fortunately, many properties have not reached a condition where stability has become an active question, but in some cases vexatious happenings have arisen from unstable conditions, and with the present developments in interconnection this problem becomes of great importance. It is to be hoped that definite data on this subject will soon be available from the application to it of technical skill, so that commercial developments may be made in the light of exact technical knowledge of what may be expected from installations.

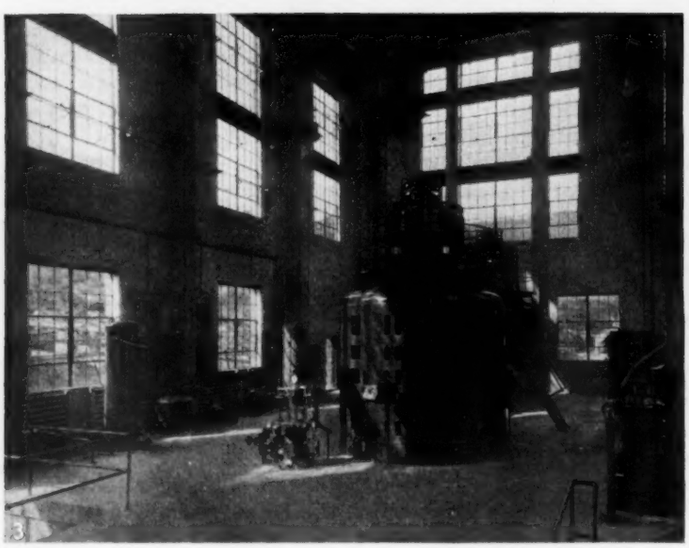
An Eastern High-Head Hydro-Electric Development

THE Deep Creek development of the Youghiogheny Hydro-Electric Corporation operates with a head of 437 ft. on Deep Creek, a tributary of the Youghiogheny River in western Maryland. This plant went on the line in July with an installed capacity of 24,000 hp. The ultimate capacity, when four other dams and three more power houses are built, will be 150,000 hp. Power generated by the Youghiogheny Company, a subsidiary of the Pennsylvania Electric Corporation, controlled by the Associated Gas & Electric Company, will be used to carry the peak load of the Penn Public System, and when the project is completed it will be one of the chief sources of power for the system, which extends northward from Deep Creek to Erie, Pa.

Fig. 1—Penstocks under construction.
Fig. 2—A view of the switchyard.
Fig. 3—The two 12,000-hp. generators, which will generate about 41,000,000 kw.-hr. annually.
Fig. 4—Tunnel which carries water from the 5,000,000-cu.ft. storage lake to the power house.







Locating Circuit Faults

Inherent Errors of Generally Used Methods and Relative Merits—Other Methods Which Have Better Characteristics for This Class of Work and Are Inherently Capable of Better and Desired Accuracy

By S. ARONOFF
Electrical Engineer, Electric Meter Laboratory, Union Gas & Electric Company, Cincinnati

LOCATION of faults in power transmission cables usually involves the succeeding steps: (1) Determination of the nature of the fault. (2) Reduction of fault resistance. (3) Prediction of the approximate location of the fault. (4) Its exact location by search methods.

However, the time consumed in locating the fault depends to a large degree upon the accuracy of the methods of prediction. At present the methods employed in determining the approximate location of a fault are unsatisfactory chiefly because of the nature of the work and because of the inherent errors of these methods. It will, therefore, be the object of this paper to point out the inherent errors of the present methods and to propose other methods which have better characteristics for this class of work.

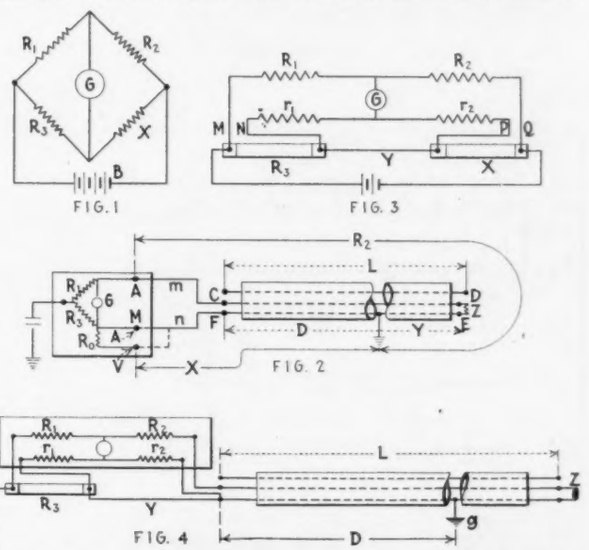
Fault location, in general, as determined from tests at either extremity of a cable, depends upon the utilization of some property of the cable which is directly proportional to its length. From a knowledge of the unit value of this property the distance to the fault from the measuring station may be computed. The most advantageous property generally used in locating nearly all faults other than "opens" is the resistance of the cable conductors. The range of resistance values that may be encountered in fault location is very wide, depending upon the length of the cable, size of conductor, resistance of fault, temperature and so forth. Because the various methods must have their limitations, care must be exercised in applying the test methods in a proper manner so as to reduce the errors to a minimum.

Power-transmission lines present a special problem in fault location on account of the resistance of the cable conductors and on account of the maximum allowable errors. For example, if a fault occurred in a cable 10 miles in length, the maximum allowable error would have to be inside 0.3 per cent to 0.5 per cent in order to locate the fault within a cable length. Furthermore, the unit resistance of the average cable conductor is so low that contact or lead resistances which may be introduced in the measuring circuit may become of such magnitude as to be equivalent to long lengths of cable conductor.

LIMITATIONS OF WHEATSTONE BRIDGE METHOD

The predictive methods most generally used in fault location involve the Wheatstone bridge principle, which inherently has certain limitations. The condition for maximum sensitivity of the Wheatstone bridge shown in Fig. 1 is that the resistances R_1 and X must be the lowest. The general application of the Wheatstone bridge to fault location is illustrated in Fig. 2. The resistance R_0 is optional, depending on whether the Murray loop or the Varley loop is used. In general practice the resistances R_1 and R_2 are the highest, while R_3 and X are the lowest. The purpose in using this arrangement is to eliminate errors due to stray currents in the cable. It becomes obvious that the Wheatstone bridge circuit as applied to fault location in power cables is used under minimum sensitiveness.

Upon examination of the circuit shown in Fig. 2 it will become apparent that the resistance R_2 includes the contact resistances at a, c, d and e as well as the strap resistances m and z. Similarly, the resistance X includes the contact resistances at b and f and the re-



FIGS. 1 AND 2—THEORETICAL DIAGRAM AND GENERAL APPLICATION OF WHEATSTONE BRIDGE TO FAULT LOCATION

The resistances R_1 and R_0 as well as the junction of R_0 and R_2 usually terminate in binding posts. The posts M and V represent the proper connection for the Murray loop and Varley loop respectively.

FIGS 3 AND 4—ELEMENTARY CIRCUIT AND GENERAL APPLICATION OF KELVIN BRIDGE TO FAULT LOCATION

The resistances R_1 r_1, R_2 r_2 are separate units which may be called a "ratio box.".

FORMULAS FOR CALCULATING DISTANCE TO A FAULT WITH MURRAY AND VARLEY LOOPS RESPECTIVELY

The values of C_1 and C_2 are the contact resistances included in R_2 and X respectively. These values are indeterminate because they depend upon a number of factors present and exercised at the point of contact. Nevertheless, they are not absolutely negligible and may be frequently equivalent to a considerable length of cable.

Method	Distance to Fault	
	D { With contact and strap resistances accounted for } $= X$	D { With contact and strap resistances neglected } Does not $= X$
Murray loop	$D = \dfrac{(m + 2L + Z + C_1) - (R_1/R_3)\ (n + C_2)}{R_1/R_3 + 1}$	$D = \dfrac{2L}{R_1/R_3 + 1}$
Varley loop	$D = \dfrac{(m + 2L + Z + C_1) - (R_1/R_3)(R_0 + n + C_2)}{R_1/R_3 + 1}$	$D = \dfrac{2l - [(R_1/R_3)\ R_0]}{R_1/R_3 + 1}$

sistance of the strap n. The introduction of these quantities alters the formula for D (distance) considerably, as shown in the formulas. The resistances of m, n and z must always be very small as compared with the unit resistance of the cable under test. In general practice, however, this is not being strictly adhered to. A comparison of the corresponding formulas in the table on page 1041 will indicate that when the contact and strap resistances become appreciable as compared with the unit resistance of the cable conductor, their omission in the calculation and the computation of D from a measurement of X on the basis of the unit resistance of the cable will introduce considerable errors.

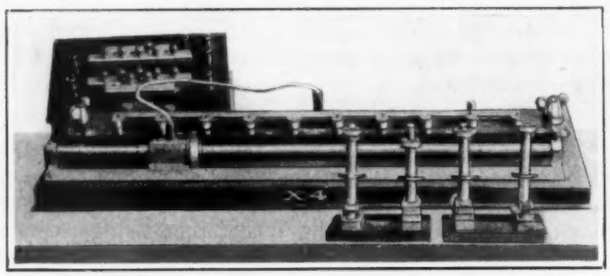


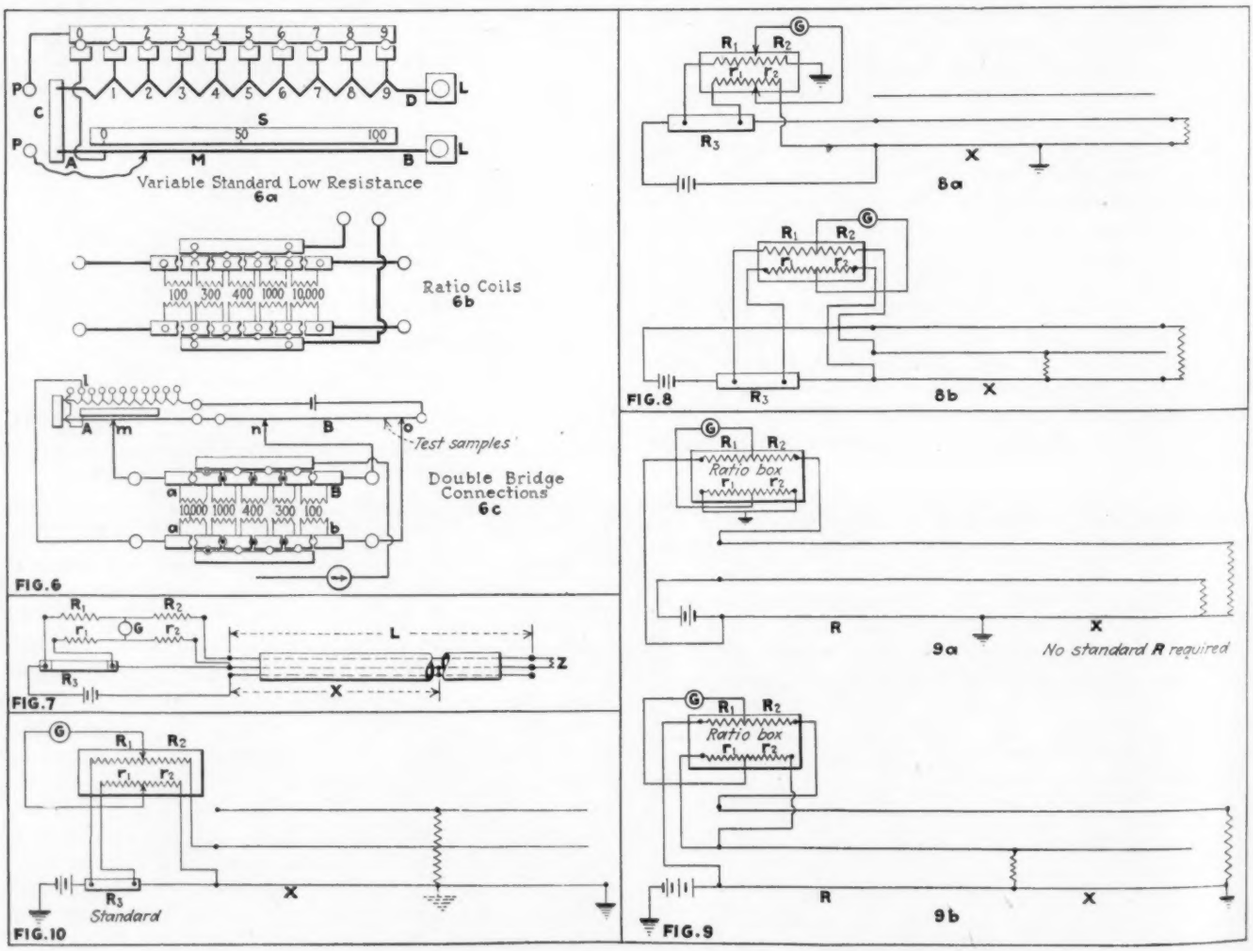
FIG. 5—KELVIN BRIDGE DESIGNED FOR LABORATORY WORK

It involves (1) a continuously variable standard resistance of 0 ohm to 0.01 ohm; (2) ratio box—intermittent in range—up to 11,800 ohms total; (3) clamps.

Therefore the errors involved in the uses of the Wheatstone bridge principle in locating faults in power cables may be summarized as follows: (1) Error due to use of Wheatstone bridge arrangement under conditions of minimum sensitivity; (2) errors due to contact resistances; (3) errors due to resistances of connecting leads.

KELVIN DOUBLE BRIDGE ELIMINATES ERRORS

In order to eliminate the inherent errors of the Wheatstone bridge principle several methods may be used. The best available method, in the opinion of the writer, which has not been applied to fault location and which makes contact and strap resistances absolutely negligible, is the one based on the Kelvin double-bridge principle, the elementary circuit diagram of which is shown in Fig. 3. In the Kelvin bridge the unknown resistance X is compared with the standard resistance R_3 through the intermediary high resistances R_1, R_2, r_1, r_2. A balance of the galvanometer is obtained when $R_1 \div R_2 = R_3 \div X$ and the conditions are that $R_1 = r_1$ and $R_2 = r_2$. The resistances of the connecting leads m, n, p and q, as well as the contacts at each end of these leads, may be neglected because they are in series with high resistances connected across the standard and unknown. Furthermore, the balance is independent of the resistance of the connecting lead Y.



KELVIN BRIDGE PRINCIPLE AND SCHEMATIC DIAGRAMS FOR LOCATING FAULTS

Fig. 6 a, b and c. Schematic diagrams of Kelvin bridge designed for laboratory determinations of resistance.

Fig. 7—Method of locating a cross between two conductors.

Fig. 8a and 8b—Kelvin bridge principle adapted to locating grounds and crosses where the faults are of a disappearing nature.

Figs. 9a and 9b—Kelvin bridge adapted to locating grounds and crosses without the use of standard resistance. In these circuits the two parts of the cable on either side of the fault are compared against each other.

Fig. 10—Kelvin bridge adapted to locating a cross between several conductors which may or may not be grounded.

The general application of the Kelvin bridge principle to fault location is illustrated in Fig. 4. It is evident that the resistance of D of a cable length from the measuring station to the fault is measured directly against a standard resistance R_3. The resistances R_1, r_1, R_2, r_2, are separate units which may be called a "ratio box." An additional advantage of this method, other than the elimination of the errors due to contact and strap resistances, is the fact that higher currents may be used to increase the sensitivity and accuracy of the bridge. The limit in current is determined by the capacity of the cable under test or that of the standard resistance.

For locating faults in power cables the Kelvin bridge may be arranged more suitably by having a continuous-range ratio box and fixed standard resistances. With such an arrangement the apparatus may be more convenient for handling and easier to manipulate. Furthermore, with a continuous-range ratio box it is possible to use the Kelvin bridge even without standard resistances for the majority of fault conditions.

The method of measuring the distance to an ordinary ground, to a cross between two conductors and for locating grounds and crosses respectively where the faults are of a disappearing nature is shown in Figs. 4, 7 and 8. The difficulties experienced with faults of the latter nature are that when current is passed through them they warm up and the fault disappears or changes and makes it impossible to take measurements with the average methods. With the arrangement shown in Fig. 8, however, the battery current does not pass through the fault and therefore will not cause the fault to disappear. The only current passing through the fault is that drawn by one side of the ratio-box resistance, and this current is so small that its effect is negligible.

The arrangements shown and discussed heretofore make use of a standard fixed resistance, R_3. As mentioned before, however, the Kelvin bridge may be so arranged with a continuous range ratio box that the standard resistance may be eliminated and thus simplify the arrangement considerably. This simplification is shown in Fig. 9, indicating the application of the Kelvin bridge to locating grounds and crosses respectively. In these circuits the two parts of the cable on either side of the fault are compared against each other. The distance to the fault from the measuring station is:

$$R = L \div [(R_2/R_1) + 1]$$

The ratio R_2/R_1 is noted when a balance of the galvanometer is obtained.

It is interesting to note that R may be computed either in ohms or in feet directly. Thus when L is given in ohms R is in ohms; similarly, if the length of the cable is known in feet, then R will be given in feet. Furthermore, the percentage of R of the entire length of the cable equals:

$$100 \div [(R_2/R_1) + 1].$$

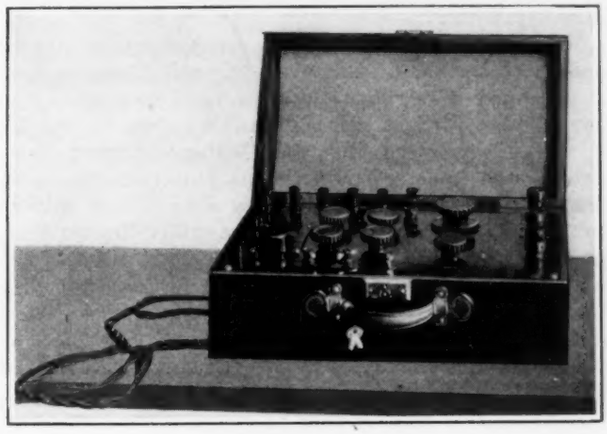
This means that the ratio box may be so calibrated that it will give the distance to the fault directly in terms of the percentage of the cable length.

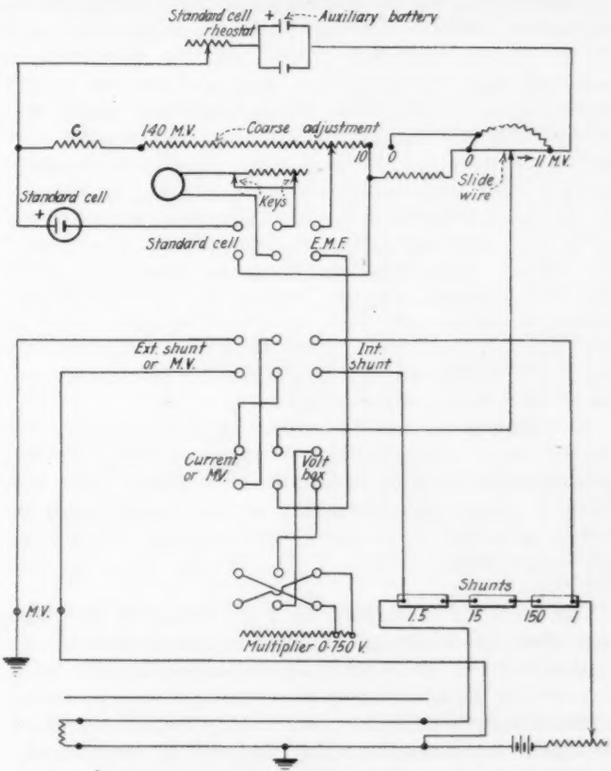
The location of a fault involving a number of crossed conductors which are or are not grounded may also be accomplished with the Kelvin bridge principle by the method shown in Fig. 10. This condition could not be handled by the Wheatstone bridge method. A compact portable instrument using the Kelvin bridge may be easily arranged by means of which the total resistance of the faulty conductor as well as the resistances on either side of the fault could be measured. With this equipment the operator would have an easy and quick check on his work.

POTENTIOMETER PRINCIPLE IS VERY ADAPTABLE

The potentiometer principle may also be suitably adapted to fault location. As in the case of the double bridge, the errors due to lead and contact resistances may be entirely eliminated.

With the potentiometer the resistance of that part





FIGS. 11 AND 12—PORTABLE POTENTIOMETER FOR FAULT LOCATION WITH SIMPLIFIED DIAGRAM

Contains shunts with a capacity of 150 amp., a voltage box up to 750 volts, millivoltmeter terminals as well as the standard cell and auxiliary batteries.

of the cable included between the measuring station and the fault is determined. The resistance is calculated from the simultaneous readings of current through and voltage drop over the particular section of cable; the distance is then calculated from a

knowledge of the unit resistance of the cable. Obviously, this method is unlike the usual method of ammeter-voltmeter measurements because it is a null method and, therefore, the errors due to the instruments are eliminated.

A convenient form of potentiometer is shown in Fig. 11, which can be connected to any circuit with no more difficulty than ordinary indicating instruments. The simplified circuit diagram of the potentiometer as well as its connection to a cable for fault location is shown in Fig. 12. The procedure in testing is first to check the auxiliary battery against the standard cell and then to balance the unknown emf. against the auxiliary battery.

Because of the number of measurements that may be made with the same instrument the potentiometer may be arranged in various ways for fault location. The arrangement for locating a ground is shown in Fig. 13. It will be observed that the battery current flows through the fault. Where this is objectionable, as in disappearing faults, the grounded side of the battery current may be interchanged with a millivoltmeter lead, thus allowing the main current to flow through the conductor and causing the ground to be in series with the millivoltmeter leads. For locating a cross on a number of conductors which may or may not be grounded the potentiometer may be applied as shown in Fig. 14.

A number of the methods discussed have been tried by the writer on an experimental lead-sheath, three-conductor, 400,000-circ.mil paper-insulated cable 332 ft. in length installed under varying temperatures especially for tests. Artificial faults of various natures were applied on the cable and a number of tests were made with the Kelvin bridge, the potentiometer and several commercial arrangements of the Wheatstone bridge. The results of the tests indicated that for all ordinary grounds and crosses the Kelvin bridge was most accurate, being in error only 0.13 per cent to 0.32 per cent. The potentiometer gave results in error between 0.24 and 0.8 per cent, while the Wheatstone bridge arrangements were in error between 1 and 25 per cent. In locating a short of three conductors both the Kelvin bridge and the potentiometer functioned with an error within 0.9 per cent.

In addition to the foregoing tests, a ground was located on a 250,000-circ.mil, three-conductor underground cable 6,235 ft. in length. The fault, which was 4,815 ft. from the measuring station, was found by means of a Kelvin bridge (with 10 amp. through the current circuit) within 6 ft., or an error of 0.12 per cent.

The methods illustrated in Figs. 8 and 9 obviously have the disadvantage of introducing errors in the readings due to stray currents which are likely to occur in practice. In an attempt to correct for this source of error, the Kelvin bridge and the potentiometer were arranged as shown in Figs. 15 and 16 respectively. Reversed readings were taken while "stray current" was allowed to pass through the cable sheath and averaging the results the distance to the fault was computed. Tests indicated that using this method, the accuracy obtainable is the same as that obtained from a single reading on a cable which is not influenced by stray currents. Furthermore, the accuracy obtained is not greatly impaired by the ratio of testing current to stray current, although the most consistent results are obtained with higher ratios of these currents, namely,

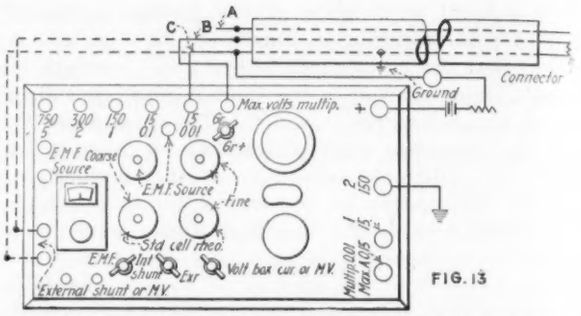


FIG. 13—CONNECTION OF PORTABLE POTENTIOMETER FOR LOCATING A GROUND

The diagram shows the use of a volt box for the measurement of the voltage drop on the conductor. The dotted line indicates the connection in using the millivoltmeter terminals to measure the voltage drop. Assuming that *A* and *B* are crossed, the grounded lead of the instrument would be connected to the conductor *A*.

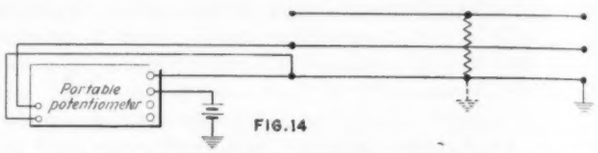
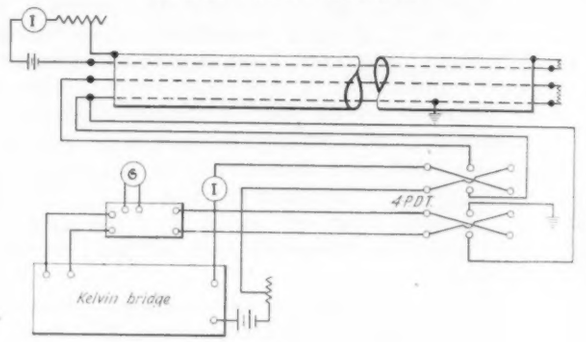
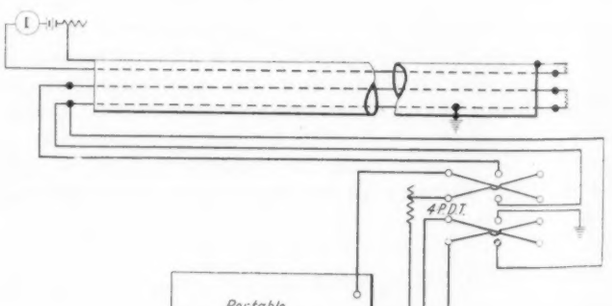


FIG. 14—POTENTIOMETER ADAPTED TO LOCATING A CROSS BETWEEN A NUMBER OF CONDUCTORS WHICH MAY OR MAY NOT BE GROUNDED





FIGS. 15 AND 16—METHOD OF CONNECTING THE KELVIN BRIDGE AND POTENTIOMETER RESPECTIVELY TO COMPENSATE FOR STRAY CURRENTS

more than five to one. Tests have indicated that the best results are obtainable when the unit resistance of the cable is determined at the time when tests for fault location are being made.

To ascertain what values of ground resistance affect the readings of the fault-locating instruments, resistors were placed in series with one leg of the ratio box of the Kelvin bridge and in the millivoltmeter leads of the potentiometer. In the case of the Kelvin bridge 20 ohms did not affect the accuracy and in the case of the

potentiometer 1,000 ohms was not noticeable. It may be noted, however, that the series resistance on the Kelvin bridge can be still further increased without affecting the accuracy if the total resistance of the ratio box is high. Furthermore, the ground resistance could considerably exceed 1,000 ohms in the case of potentiometer without introducing appreciable errors.

CONCLUSIONS

In conclusion, it is the writer's opinion that the Kelvin bridge principle of locating faults is superior to present methods because: (1) It eliminates errors due to contact and connecting lead resistances; (2) it is more accurate and used under maximum sensitivity; (3) it may be arranged so that no standard resistances will be required for ordinary crosses and grounds; (4) it is immune to current fluctuations in the current circuit; (5) it can be used so as to eliminate stray current errors; (6) it can take care of a greater variety of faults than present methods; (7) for the most part ground resistances may not have to be broken down. Its disadvantages are (1) the need of a sensitive galvanometer and (2) care of manipulation.

Next to the Kelvin bridge the potentiometer principle is superior to present methods because: (1) It eliminates errors due to contact and strap resistances; (2) it is more accurate and more senstive; (3) it can be arranged so that no standard resistances are required; (4) it can be arranged so as to eliminate stray current errors; (5) it can take care of a greater variety of faults than present methods; (6) for the most part ground resistances do not have to be broken down. Its disadvantages are: (1) That current must remain constant for a period sufficiently long to take current-voltage readings and (2) the care necessary for manipulation. Another disadvantage of the potentiometer —one which may be eliminated, however, with a different design—is the need of a standard cell.

Importance of Incandescent Lamp Sales

In Three Months Henry L. Doherty Subsidiary Companies Sold 541,000 Lamps Valued at $169,182, Totaling 33,000,000 Watts—Average Watts per Lamp Increased from 40 to 60

By FRED I. SMITH
Henry L. Doherty & Company, New York

CONVINCED that the sale of more incandescent lamps to customers would result in direct benefits to its electric properties in the form of increased load, revenue and good will, the new-business departments of Henry L. Doherty & Company conducted an intensive lamp sales campaign during February, March and April of this year. Two underlying objects in this campaign were, first, to increase the lighting load through the sales of larger-sized lamps to replace the lamps already in use and fill empty lamp sockets. The second object was to enhance customers' good will by giving them the best of service in recommending proper-sized lamps to produce correct illumination and to teach the customers that the central-station company was competent to assist them in all problems regarding light and lighting equipment.

The idea of an intensive lamp sales campaign was a result of a study which showed the largest portion of the domestic customer's load to be in lighting equipment. Reasoning from this basis, it was felt that an increase in the lighting load would result in a worth-while increase in revenues. Experience justifies this conclusion, inasmuch as the sale of a number of kitchen fixtures equipped with 150-watt lamps to replace lamps averaging approximately 50 watts has resulted in increased revenues of about $8 per year per unit installed. The revenue from lighting is the product of wattage connected and burning hours. Since burning hours are largely beyond the control of the service company, increased revenues can only be brought about by increased wattage. Hence the basic idea of the incandescent lamp sales campaign was the sale of higher-wattage lamps to replace the lamps already in use.

Information from reliable sources shows that, taking the country as a whole, the average customer buys seven lamps per year for a total of 280 watts, or, roughly, seven 40-watt lamps are sold per customer per year. The lighting equipment in the average home has been found to be about 900 watts. Dividing the total wattage per home by the wattage of the average lamp sold, the average home contains about 22.5 lighting outlets. As seven lamps are purchased each year by the average customer, approximately one-third of the lamps in homes are replaced each year. If intensive sales activities should induce the customers to buy 60 instead of 40-watt lamps, the lighting load per average customer would be increased from 900 to 1,350 watts in three years, or an increase of 50 per cent.

TABLE I—TOTAL INCANDESCENT LAMP SALES IN THREE MONTHS

	No. of Sales Representatives	No. of Customers	Total Sales in Watts	Sales in Watts per Customer	Total Sales in Dollars
Residential territory	206	291,764	24,525,795	84.02	$118,395.92
Commercial	20	21,551	4,506,132	209.09	21,594.14
Power	15	2,899	2,001,233	690.32	7,780.96
Floor	....	.....	2,259,145	.....	21,411.19
Total	241	316,214	33,292,305	105.28	$169,182.19

The announcement of the lamp sales contest was made by mail to all electric new-business departments two weeks before the date set for the beginning of the contest. It carried with it a list of the prizes offered to the new-business managers and sales representatives of the various classes, together with a thorough survey of the possibilities of lamp sales.

Forty-five prizes were offered, the total value of which was more than $3,000. In addition to these prizes an additional merchandise commission on lamp sales was put into effect for the three months of the contest. In order to create an incentive to sell the larger-sized

lamps, the prizes were offered to the men and departments making the highest sales in watts per customer. The idea of watts per customer was stressed continually both prior to and during the contest. The sale of lamps was to be carried on in conjunction with the regular department work—extra work, hence extra commissions to the salesmen.

The contest started on Feb. 1. Each department submitted a complete report every fifteen days, at which time the New York office published a booklet showing the standings of the men and departments, together with successful sales methods used by some of the departments. This publication was valuable in keeping the men interested and in stimulating sales.

TABLE II—LAMP SALES IN DOLLARS

	1923	1924	1925
February	$20,335.60	$21,890.71	$37,531.79
March	23,825.72	21,492.81	40,744.77
April	19,917.44	17,582.69	90,905.63
Total	$64,078.76	$60,966.21	$169,182.19

Twenty-five electric companies participated in the lamp sales contest. These twenty-five departments served 316,214 electric customers and employed 241 sales representatives. All told, customers purchased $169,182.19 in lamps, totaling 33,292,305 watts. Total wattage of lamps sold divided by total customers gives 105.26 watts per customer. The general average throughout the country of lamps sold per customer for any three-months period is approximately 70 watts. In other words, while the average electric customers throughout the country purchased lamps totaling 70 watts, each electric customer of the twenty-five Doherty companies that took part in the lamp sales contest purchased lamps totaling 105 watts. Furthermore, while the average electric customers of the country purchased 40-watt lamps, the Doherty customers bought, on the average, 60-watt lamps. The sales representatives were divided into three classes: Residential territory, commercial and power. Table I shows the sales by each class and also the floor sales.

LAMP SALES ALMOST TREBLED

The extent to which the companies entered into the contest is reflected by the fact that the lamp sales in dollars during the campaign amounted to $169,182, as against sales in 1924 during the corresponding months of $60,966 and $64,079 in the same three months of 1923. In other words, the lamp sales during February, March and April, 1925, were nearly three times those of the corresponding months in 1924 or 1923. Table II shows a comparison of lamp sales for the three years.

In the opinion of many central-station merchandising men, the sales of incandescent lamps by central stations have been decreasing. This trend has been explained as the result of concentration on the sale of electric appliances at the expense of the sale of incandescent lamps. Furthermore, it is claimed, many executives have entertained the idea that customers will buy incandescent lamps of their own accord and that sales activities in lamps are unnecessary.

The results of the Doherty lamp sales contest show that sales activities in lamps result in several benefits to the electric company and to the customer. The customer is sold lamps of adequate wattage to insure him better lighting and the company receives an added load. The customer is brought to consider the central-station company as the headquarters for electrical merchandise, and the possibilities of other sales to the customer are greater. Courteous treatment and service to customers through lamp sales afford opportunities for building up valuable good will.

Although the lamps sold during the contest were a large percentage of the total lamps sold during the twelve months of 1924, many indications point to continued large sales. In other words, it is apparent that the contest did not merely stock the customers with a large supply of lamps, the result of which would be proportionally reduced sales for the balance of the year. Many large contracts for lamps were taken during the contest; lamp sales have been exceptionally good since the close of the contest, and customers have learned that lamps can be purchased by telephone. Besides these reasons for expecting continued lamp sales, the people of the towns and cities in which the contest was carried on have been educated to the value of light and are taking care to see that their homes, stores, offices and factories are properly illuminated. This is a very worth-while gain, inasmuch as the light "habit" is one that sticks. Experience has shown that very few people will change from good lighting to poor lighting.

COMPARISON WITH NATIONAL AVERAGE

Any attempt to forecast the revenue increases due to the lamps sold during the contest must be based on assumptions. However, it is possible to compare the definite results obtained by the lamp campaign with the results of a national survey conducted recently by a large lamp manufacturer. As above mentioned, this survey shows that the average lamp purchased by the electric customer is a 40-watt lamp. Assuming that the 316,214 customers of the Doherty companies were average customers at the beginning of the contest, each customer would have had an average of 22.5 lamp sockets and would have bought, during the three months of the contest, 1.75 lamps of 40 watts each.

The results of the lamp campaign show, however, that 554,041 lamps (a total of 33,292,305 watts) were sold to the 316,214 customers. In other words, the sales averaged 1.75 lamps of 60 watts to each customer. This is an increase of 50 per cent over the country average in wattage per lamp sold. The fact that the average customer purchased 1.75 lamps during the campaign, which is the same as the national average of lamps sold per customer, proves that abnormal sales were not brought about, but that all the normal requirements of the average customer were supplied.

CAN INCREASE REVENUE 25 PER CENT

Assuming that all of the 554,041 60-watt lamps sold will ultimately be used to replace lamps now in use (40 watts average) an added load of 11,130,665 watts will result. Furthermore, the revenues that have resulted from the 40-watt lamps that have been, or will be, replaced by the 60-watt lamps sold during the contest should be increased 50 per cent due to the increased wattage. In actual dollars this increase should be very worth while, although an exact figure is practically impossible to determine in advance.

The twenty-five companies that took part in the Doherty lamp sales contest are scattered throughout eleven states. The new-business department of the Bartlesville Gas & Electric Company, Bartlesville, Okla., won the first prize in the contest with lamp sales of

571.05 watts per customer. This department sold 30,472 lamps, totaling 2,293,325 watts, hence the average lamp sold was 75 watts. The Bartlesville company had 4,016 electric customers at the time of the contest, hence an average of 7.6 lamps was sold to each customer. Assuming, as above, that these lamps are all ultimately used to replace average lamps now in use (40-watt) the increased load would amount to 1,066,520 watts, which would be an increase of 87.5 per cent in load. This 87.5 per cent increase in load will undoubtedly have some effect on revenue.

Bartlesville, a comparatively young town, has always been well lighted. This has been an advantage to the Bartlesville company, as customers were already "sold" on electric lighting. Nevertheless, the initiative and

TABLE III—LAMPS SOLD BY TWENTY-FIVE COMPANIES

Company and Standing	Customers	Sales in Watts	Watts per Customer	Sales in Dollars
1 Bartlesville	4,016	2,293,325	571.05	$10,289.53
2 Adrian	3,968	1,842,375	464.31	7,232.45
3 Athens	2,905	1,314,465	452.49	6,265.60
4 Danbury	6,608	1,863,550	282.01	9,072.34
5 Galveston	5,789	1,343,495	231.97	7,371.37
6 Cheyenne	3,972	704,545	177.38	3,724.94
7 Durham	6,540	1,036,970	158.35	4,028,28
8 Amarillo	4,913	772,780	157.29	4,003.06
9 Massillon*	7,488	1,080,170	144.51	5,283,34
10 P. S. Colo.-Western	10,445	1,434,435	177.16	7,604.87
11 Ashland*	2,784	351,055	126.09	2,378.98
12 Mansfield	8,497	1,005,820	118.37	4,009.46
13 St. Joseph	22,565	2,186,615	96.90	9,271.58
14 Toledo	78,569	6,549,050	83.35	38,965.78
15 Colorado Power*	8,714	691,752	79.33	3,888.70
16 Sandusky*	6,870	533,110	77.51	3,217.14
17 Warren*	9,631	737,055	76.50	4,363.41
18 Port Clinton*	2,273	172,069	75.68	1,030.29
19 Joplin	14,914	1,117,668	74.94	5,871.88
20 Sedalia	5,078	380,298	74.89	2,313.06
21 Alliance*	7,767	571,965	73.64	3,007.95
22 Elyria*	6,134	446,490	72.78	2,427.17
23 Denver†	72,777	4,344,908	58.89	20,963.42
24 Lorain*	7,749	378,133	47.71	1,781.15
25 Bristol	4,248	140,208	33.06	816.44
Total	316,214	33,292,305	105.28	$169,182.19

* Division of Ohio Public Service Company.
† Division of Public Service Company of Colorado.

constant efforts of the new-business manager, Thomas C. Brill, and his five sales representatives were the factors that gave Bartlesville even better lighting and incidentally won the lamp sales contest.

This department did not get fully started in the lamp campaign until the last month, as it was at work on pre-arranged duties not connected with selling. However, during the month of April Bartlesville started out to make up for lost time. The following methods were employed by the Bartlesville Gas & Electric Company to stimulate lamp sales:

1. *Motor Car Parade.* To advertise the campaign the new-business department organized a parade of all the company and employee automobiles. A local police escort was secured, all the automobiles were appropriately decorated and the parade passed through the principal streets of the town and was successful in two ways: first, in advertising the lamp campaign and better lighting to the people of Bartlesville and, second, in inspiring the sales organization.

2. *Portable Lamp Campaign.* Window and floor displays of table and bridge lamps equipped with 100-watt lamps were arranged. Newspaper advertising and solicitation of orders for these lamps, together with sales floor efforts, resulted in the sale during five weeks of more portable lamps than had been sold by the Bartlesville company during the last three years.

3. *Kitchen Fixture Campaign.* A two-weeks campaign on kitchen lighting units, during which intensive solicitation, backed up by intensive advertising, resulted in the sale of a large number of these fixtures, even though this equipment had been already successfully campaigned.

4. *Residence Lighting Campaign.* A campaign on residence lighting fixtures was conducted during April along with the other campaigns and resulted in the sale of 511 fixtures equipped with one or more 50-watt lamps. These fixtures added approximately 84,000 watts in active load.

5. *House Wiring Campaign.* A portable lamp was offered to each customer who would spend $30 or more in house wiring. This offer was accepted by thirty-four new customers, most of whom were in the poorer sections of the city. The average lighting equipment sold to these new customers was 960 watts.

6. *Store Lighting Campaign.* Store lighting units to the number of 155 were sold during the three months of the contest. The average wattage installed was 235 watts.

7. *Dollar Day.* More than 1,000 packages, each containing at least one dollar's worth of lamps and some containing tickets entitling the buyer to some slightly shopworn electric appliance or kitchenware, were sold at $1 each in less than two hours. Most of the lamps sold in this way were 75- or 100-watt lamps; the average lamp sold in this manner was 84 watts.

8. *Industrial Lighting Campaign.* Ninety per cent of the industrial plants, business houses, churches, banks and schools were signed up on lamp contracts. This endeavor produced good results and secured many new lamp customers.

HALF A MILLION LAMPS SOLD IN THREE MONTHS

The results in the contest by companies is shown in Table III. In brief, twenty-five new-business departments of the companies operated by Henry L. Doherty & Company participated in an incandescent lamp sales campaign during February, March and April, 1925. These departments sold 554,041 lamps averaging 60 watts each to 316,214 customers. This is an increase in watts per lamp sold of 50 per cent over the average for the country as a whole and should reflect itself in increased revenues.

Good will was increased, customers pleased, merchandise sales increased, new merchandise customers developed, the public educated to better lighting and load was added. All hoped for results were obtained in greater measure than expected and the companies that took part in this activity have greatly advanced their positions in the communities in which they operate, because they have opened new doors to real service to their customers.

Hydro-Electric Development in Bulgaria

ALTHOUGH it is estimated that Bulgaria has water-power resources to the extent of about 1,000,000 hp., little has so far been done regarding their utilization for the generation of electric power, the majority of the various industrial undertakings in the country relying upon coal drawn from the state collieries at Pernik. Since the war, however, much greater attention is being paid to the question of water-power utilization.

As a first step the government has nationalized all available water power and drawn up a schedule of the terms on which it is prepared to grant concessions for a period of years. Among the more important hydro-electric stations now in course of construction are the Watscher, on the River Kritschin, and the Orion undertaking, on the Rila River. The last named will comprise three stations, at Rila, Pastra and Ilina respectively. The first portion of the Pastra plant has already been completed and comprises three 3,300-hp. Francis-type turbo-generators rated at 5,000 volts, 50 cycles, 1,000 r.p.m. The output is being utilized for lighting and power purposes in the town of Subrica, at various factories in the vicinity and at the state collieries at Pernik.

1925 Actual Construction Expenditures Exceed Budgets by $52,520,000

FIGURES on actual construction expenditures by central-station companies during 1925 as submitted to the ELECTRICAL WORLD indicate that the construction budgets for the year as published in the March 14, 1925, issue of ELECTRICAL WORLD have been exceeded by $52,520,000. The actual expenditures for additions to the generation, transmission and distribution systems of the country during 1925 totaled $632,350,000, against an estimated budget at the opening of the year of $579,830,000, indicating that in order to take care of the growth of operations the industry was forced to spend almost 10 per cent more than it had contemplated for additions and extensions during the year. These figures include additions and extensions to generation, transmission and distribution systems, including substations, but do not include new office or warehouse buildings.

Every section of the country except the South Atlantic States appears to have exceeded its construction budget for the year. The North Central States lead with $214,450,000, or $30,210,000 over the budget set for the year, and the Pacific States exceeded their budget for the year by $19,780,000.

The outstanding fact indicated by these 1925 expenditures is that over a third of the total amount was spent for additions to the distribution systems of the country. Back in 1921 the expenditures were almost equally divided between generation and distribution. This trend in central-station expenditures is but the reflection of the large amount of interconnection between company systems which has taken place since 1921. The industry has arrived at the point where, through the operations of the superpower type of systems, additional power is available which calls for increased attention to the distribution of that power.

Table I—Total Value of All Additions and Extensions to Central-Station Generating and Distributing Systems During 1921, 1922, 1923, 1924 and 1925

Section	1921	1922	1923	1924	1925
New England States	$13,634,000	$15,225,000	$24,996,000	$55,200,000	$51,720,000
Middle Atlantic States	29,502,000	86,300,000	186,200,000	204,650,000	143,020,000
South Atlantic States	21,771,000	27,975,000	56,960,000	67,280,000	77,380,000
North Central States	67,900,000	96,700,000	206,180,000	218,950,000	214,450,000
South Central States	7,480,000	21,830,000	25,145,000	37,180,000	23,170,000
Mountain States	747,000	2,241,000	7,652,000	25,980,000	13,360,000
Pacific States	81,284,000	73,745,000	95,010,000	83,200,000	109,250,000
Totals for United States	$222,318,000	$324,016,000	$602,143,000	$692,440,000	$632,350,000

Table II—Value of Actual Additions and Extensions to All Generating and Distributing Systems of the United States During 1925

Section	Generating Plants			Distribution			Total Value of All Additions and Extensions
	Fuel-Burning Plants	Hydro-Electric Plants	Total Value of Additions and Extensions	Transmission Systems	Distribution Systems	Total Value of Additions and Extensions	
New England States	$15,720,000	$1,930,000	$17,650,000	$5,720,000	$28,350,000	$34,070,000	$51,720,000
Middle Atlantic States	62,600,000	8,620,000	71,220,000	25,600,000	46,200,000	71,800,000	143,020,000
South Atlantic States	3,680,000	27,300,000	30,980,000	21,200,000	25,200,000	46,400,000	77,380,000
North Central States	70,500,000	11,950,000	82,450,000	57,000,000	75,000,000	132,000,000	214,450,000
South Central States	4,000,000	400,000	4,400,000	9,500,000	9,270,000	18,770,000	23,170,000
Mountain States	600,000	10,200,000	10,800,000	1,160,000	1,400,000	2,560,000	13,360,000
Pacific States	17,850,000	45,600,000	63,450,000	10,500,000	35,300,000	45,800,000	109,250,000
Totals	$174,950,000	$106,000,000	$280,950,000	$130,680,000	$220,720,000	$351,400,000	$632,350,000

Table III—Value of Additions and Extensions to Generating Plants During 1921, 1922, 1923, 1924 and 1925

Section	Fuel Electric Generating Plants — Value of Proposed Additions					Hydro-Electric Generating Plants — Value of Proposed Additions				
	1921	1922	1923	1924	1925	1921	1922	1923	1924	1925
New England States	$8,085,000	$5,870,000	$6,270,000	$26,600,000	$15,720,000	$1,480,000	$3,690,000	$4,626,000	$5,260,000	$1,930,000
Middle Atlantic States	10,430,000	41,250,000	66,800,000	68,300,000	62,600,000	2,458,000	7,240,000	11,300,000	36,500,000	8,620,000
South Atlantic States	5,004,000	6,890,000	22,700,000	23,600,000	3,680,000	7,000,000	10,900,000	10,000,000	16,240,000	27,300,000
North Central States	22,020,000	34,700,000	107,900,000	127,500,000	70,500,000	2,680,000	9,800,000	5,180,000	7,200,000	11,950,000
South Central States	1,920,000	6,460,000	1,455,000	10,600,000	4,000,000	1,110,000	6,000,000	4,490,000	6,360,000	400,000
Mountain States	72,000	828,000	802,000	10,100,000	600,000	58,000	310,000	4,000,000	3,880,000	10,200,000
Pacific States	2,327,000	4,545,000	3,490,000	3,000,000	17,850,000	38,030,000	25,850,000	34,800,000	34,100,000	45,600,000
Totals for U. S.	$49,858,000	$100,543,000	$209,417,000	$269,700,000	$174,950,000	$52,816,000	$63,790,000	$74,396,000	$109,540,000	$106,000,00

Table IV—Value of Additions and Extensions to Transmission and Distributing Systems During 1921, 1922, 1923, 1924 and 1925

Section	Transmission Systems — Value of Proposed Additions					Distribution Systems — Value of Proposed Additions				
	1921	1922	1923	1924	1925	1921	1922	1923	1924	1925
New England States	$1,440,000	$2,570,000	$6,680,000	$10,720,000	$5,720,000	$2,629,000	$3,095,000	$7,420,000	$12,620,000	$28,350,000
Middle Atlantic States	8,240,000	20,130,000	31,200,000	26,350,000	25,600,000	8,374,000	17,680,000	76,900,000	73,500,000	46,200,000
South Atlantic States	6,197,000	5,140,000	11,920,000	18,500,000	21,200,000	3,570,000	5,045,000	12,340,000	8,940,000	25,200,000
North Central States	20,510,000	22,000,000	44,800,000	43,930,000	57,000,000	22,690,000	30,200,000	48,300,000	40,320,000	75,000,000
South Central States	2,320,000	4,150,000	9,970,000	14,900,000	9,500,000	2,220,000	5,220,000	9,230,000	5,320,000	9,270,000
Mountain States	500,000	148,000	610,000	9,630,000	1,160,000	117,000	955,000	2,240,000	2,370,000	1,400,000
Pacific States	21,450,000	21,450,000	20,020,000	10,160,000	10,500,000	19,477,000	21,900,000	36,700,000	35,940,000	35,300,000
Totals for U. S.	$60,567,000	$75,588,000	$125,200,000	$134,190,000	$130,680,000	$59,077,000	$84,095,000	$193,130,000	$179,010,000	$220,720,000

Joint Use of Frequency Changer

Installation of Flexible Coupling Capable of Being Quickly Disengaged Permits Use of Both Units of Set by Two Systems for Power Factor Correction

By C. L. FURR
Appalachian Power Company, Bluefield, W. Va.

THE Appalachian Power Company operates a three-phase 60-cycle power system in the southern part of West Virginia in the same territory in which the Norfolk & Western Railroad operates a single-phase 25-cycle system to supply power for its electrification. In 1917 the Appalachian Power Company installed a 10,000-kva. frequency changer at the switchback substation for interchanging power with the railroad. The set is rated as follows: One synchronous motor, three phase, 60 cycle, 13,200 volts, 9,750 hp., directly connected by a flange coupling to an alternating-current generator, single phase, 25 cycles, 7,000 kw., 7 p.f., 300 r.p.m., with a 250-volt, 150-kw. direct-current exciter directly connected to each machine. The 25-cycle machine is also coupled to a 220-volt, single-phase, 200-hp. repulsion motor by a jaw clutch to be used for starting the set. Until 1923 the railroad used the frequency changer as a condenser for power factor correction when it was not being used for an interchange of power, but the power company's day load finally grew so large that it needed the set to correct its own power factor.

It was therefore decided to install a flexible coupling that would meet the following conditions:

1. That the coupling would permit the operation of the units simultaneously and independently.
2. That one unit could be operated and the other unit be at rest.
3. That both units could be operated together for interchange of power.
4. The original requirements were that the coupling should be engaged and disengaged when the machines were at rest or when both machines were running. These were later modified, however, so as to permit the coupling to be engaged and disengaged only when both machines were at rest, the time to engage and disengage requiring not over five minutes.
5. That there would be no slip in the coupling to affect the parallel operation with another frequency changer set which eliminated couplings of the magnetic or friction types.
6. That the coupling was to be as strong as or stronger than the main shaft of the machine.
7. There were other requirements that had to be met such as alignment, coupling running without undue heating, size, weight, etc., that will not be enumerated.

The modification of condition 4 to read that the coupling was to be engaged and disengaged only when the machines were at rest was necessary because there were no manufacturers of couplings that could meet the other requirements willing to guarantee their coupling under this condition. It was practical to do this, but just what effect it would have had upon the coupling and machines if they had been thrown together slightly out of step was not definitely known, and the shifting device for operating the coupling in motion was expensive and complicated. After modifying this condition it was necessary to devise some simple method of bringing the machine to rest quickly. The need for an interchange of power usually occurs when one or the other of the systems is in trouble, consequently it is important that the machines be brought to rest in the shortest possible time. If the frequency changer set is running and is cut off the line and allowed to float to rest without the fields on, it takes one hour and twenty minutes for the set to come to rest. The exciters are self-excited and directly connected to the machine. If the fields of the machine are left on, it takes between thirty-five and forty minutes for the set

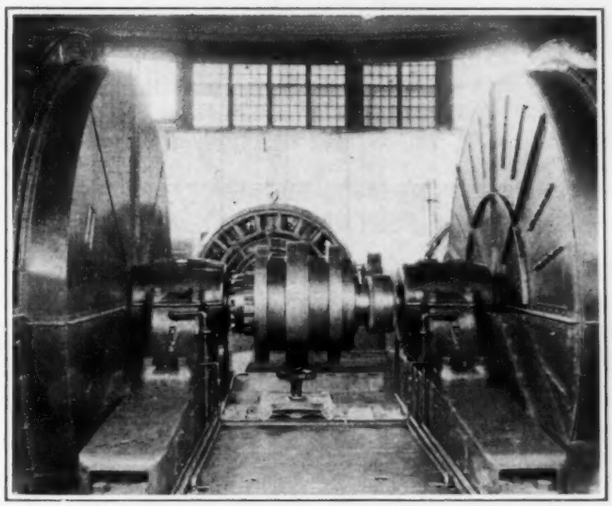


FIG. 1—VIEW OF FLEXIBLE COUPLING, SHOWING TRANSFER CAR ON A TRACK

to come to rest. The method used to bring the machine to rest in a shorter time was by the use of a small motor-generator set for separately exciting the field of the exciter and a prony brake made of a steel band, asbestos lined, on the hub shaft of each machine. With this arrangement the machines can be brought to rest in from four to five minutes.

The Fast Flexible coupling manufactured by the Bartlett-Hayward Company of Baltimore, Md., met the requirements and was installed in April, 1925. The installation of the coupling was begun on January 15, 1925, and was completed on April 27. It was necessary to move the 25-cycle end of the machine a distance of 52 in. This was done without dismantling the machine by cutting the grouting from under the bed-plates for a depth of 2 in. and introducing first plates and then two 50-ton hydraulic jacks. The machine was moved back an inch at a time, the whole operation taking fifteen hours. The coupling weighs 11,000 lb. and is composed of three main parts—namely, the two hub shafts that are bolted on to the shaft of the machines and the outside shell or case, each part having ninety-six teeth. When the coupling is engaged, the gears on the outside shell mesh with the gears on both shafts. In the disengaged position the outside shell of the coupling is moved until the teeth on the hub shaft of the 60-cycle end of the set are disengaged with the teeth of the outside case. In this position the machines are not

connected in any way and can be run as independent machines. The shifting mechanism consists of a small transfer car on a track shown in Fig. 1. To shift the coupling it is necessary to loosen two dial pins and take the weight of the outside shell on the transfer car, which is moved along an axis parallel to the shaft of the machines until the coupling is engaged or disengaged, after which the dial pins are tightened and the machines are ready to run. When the coupling is in the disengaged position the teeth of the coupling do not mesh and no oil is required. When the coupling is in the engaged position it is essential that it be filled with oil, which can be put in while the machines are running by pouring the oil in the end of the coupling between the outside shell and the shaft, centrifugal force drawing the oil into the coupling. When the coupling is put in the engaged position, the teeth must line up before they will mesh. The method used is to rotate the machine by means of a claw lever used on the notched hub. The casing is graduated on one end to show the number of teeth and space between teeth; opposite these graduations on the hub are four graduations 90 deg. apart. When one of these graduations is brought in line with any of the graduations on the casing, the coupling is in position to mesh.

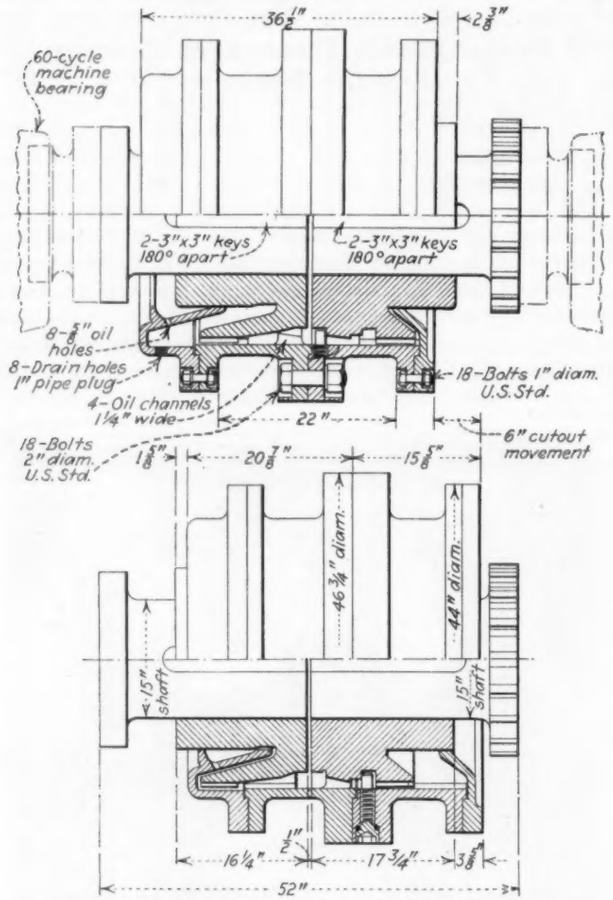


FIG. 2—COUPLING IN DISENGAGED AND ENGAGED POSITIONS

The original method of starting the set with the repulsion motor or by connecting the two exciters of the machines in series and starting from 550 volts direct-current is still used for starting the 25-cycle machine or the two machines coupled together. The 60-cycle machine is started by its 250-volt direct-current exciter, using the same starting contactor and resistances that are used when the machines are coupled together. The station direct-current voltage is 550 volts and 250 volts for starting is obtained by separately exciting the field of one of the 1,000-kw. motor-generator sets in the station.

Tests have been made under various operating conditions and the coupling has met them successfully as well as meeting all operating requirements since April in a completely satisfactory way.

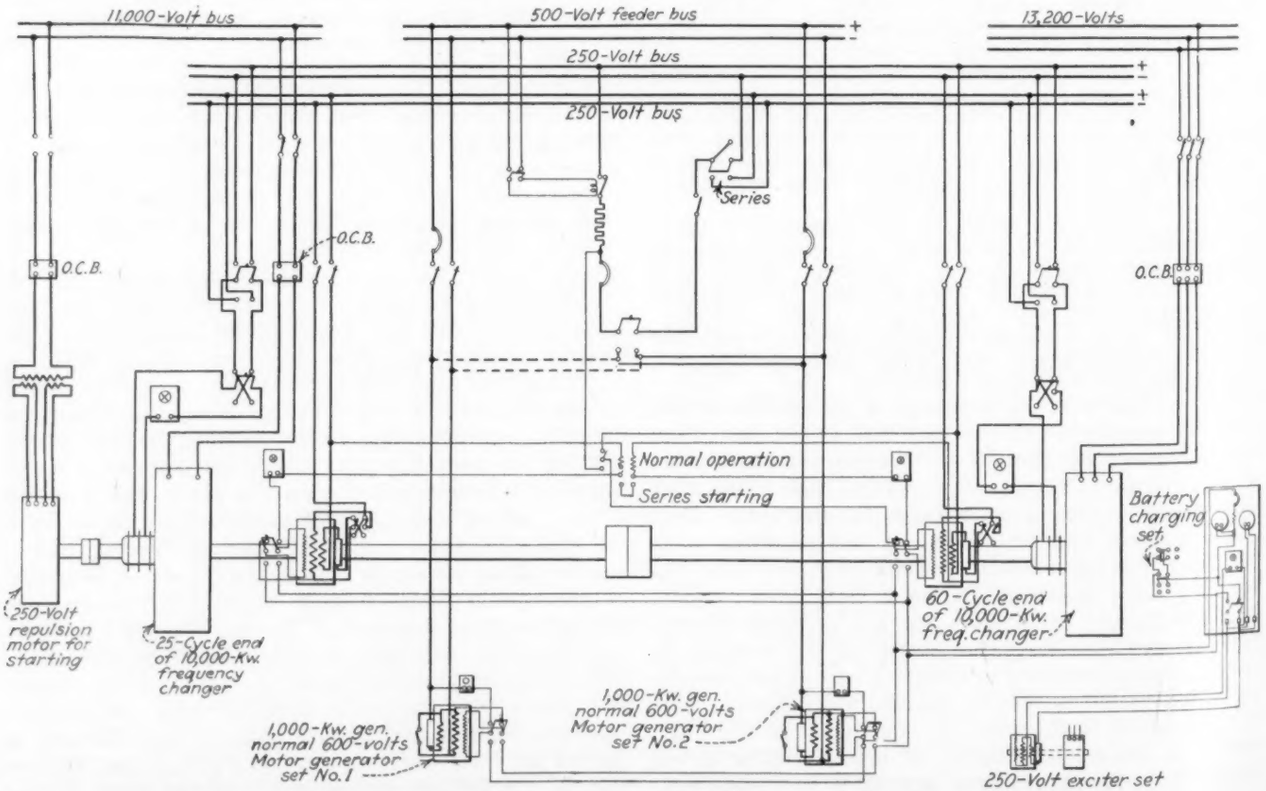


FIG. 3—DIAGRAM OF SWITCHES AND STARTING ARRANGEMENT OF FREQUENCY CHANGER SET

Value of Industrial Load Census

Accurate Surveys of Present and Prospective Power Loads in Central-Station Company's Territory Greatly Facilitate Work of Commercial Sales Department in Producing the Most Desirable Class of Business

By F. M. WELLER
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Consolidated Gas, Electric Light & Power Company of Baltimore

ONE of the principal factors in what success the Consolidated Gas, Electric Light & Power Company of Baltimore has had in building up its industrial power business has been the use of a continual census or inventory of its already connected power load and the amount of prospective business remaining in the territory served. It has enabled the company to make intelligent plans for the extension of its system and provided the means for the direction of commercial sales engineering in a most effective manner and with the minimum of wasted effort.

TABLE I—ISOLATED PLANTS, CLASSES B AND C

Number of plants	528
Boiler installation in hp	148,549
Engine installation in hp	108,101
Generator installation, kw	29,501
Average developed, hp	45,276
Hp.-hours developed per year	216,080,941

The first industrial census taken was in 1913 and comprised a survey of all commercial and industrial power users and prospects, whether obtaining their power from isolated power plants or purchasing from the central-station company or from a combination of both. Census revisions have been made and taken at regular periods during the succeeding years. These censuses in all cases have been taken by members of the Consolidated company's industrial power department, and later of the industrial fuel department, who carried on their regular work at the same time with but slight interference. It has always been felt by the Baltimore company that the members of the industrial power and fuel department were better equipped to obtain correct and complete information. The value of the census depends upon the reliability with which it is taken.

The first census, in 1913, was confined to the city limits, whereas later ones have included extensively wider territory. By utilizing the men of the industrial power and fuel department a considerable portion of the information was already at hand on certain of the larger customers with whom respective members of these departments had been dealing.

The census data were taken on sheets as shown here, which had been previously printed and prepared, and each man was assigned a definite portion of the city's territory. The map of the entire city was divided into sections, and a section handed to each man. The territory was divided into approximately eight districts, there being at that time just that number of men in the industrial power department. No census of industrial fuel users or possibilities was taken at that time.

The sheets were divided into three classifications as follows: Class A installations, using exclusively central-station power. Class B installations, using a combination of isolated plant and central-station service, and Class C installations, using exclusively isolated plant power. Classes B and C were further subdivided into three groups, depending upon the probability or the relative probability of obtaining the business for the central station at an early date or requiring a considerably longer period for negotiations.

From the Class A sheets a great deal of valuable information was obtained, such as the total number of installations, the total number of motors, the total horsepower in motors, etc. It should be noted that only installations of 1 hp. and over were included in the census. The result showed a total of 1,617 installations, total number of motors 5,095 and total horsepower in motors 50,861 in Class A.

From Classes B and C we were able to obtain the data on isolated plants shown in Table I. The analysis of isolated plants containing electric generators is shown in Table II. Regarding the nature of the drives in the isolated plants, their division by prime movers is given in Table III.

TABLE II—ISOLATED ELECTRIC GENERATING PLANTS

	No.	Kw. Installed
Plants driving generators only	60	14,894
Plants where only 50 per cent of capacity drives generators	33	6,593
Plants where less than 50 per cent drives generators	85	4,178
Total	178	25,665

TABLE III—DIVISION BY PRIME MOVERS

Motive Power	No. of Plants	Engine Hp.	Average Hp.	Average Hp. per Year
Steam and water	493	107,076	44,756	214,523,491
Oil engines	4	375	225	644,280
Producer gas engines	5	325	147	539,310
Gasoline engines	26	325	128	373,860
Total	528	108,101	45,276	216,080,941

Each member of the department when making the census carried the following letter:

To the Power Users of Baltimore:

Gentlemen: This company is endeavoring to take a comprehensive census of the power used in Baltimore and vicinity, in order to ascertain more accurately the power requirements of such customers and to bring to the attention of non-users the advantages and economies of its service.

The bearer is a representative of our industrial power department and will be glad to give you any additional information as to this census and our power rates. We trust that you will co-operate with us by aiding him to obtain accurate information as to your power requirements.

Thanking you for this courtesy, we are very truly yours,

President.

During 1922 the second complete census was made, being completed in January, 1923. This time all sur-

TABLE IV—RESULT OF INDUSTRIAL POWER CENSUS

Class No.	Industry	Class "A"—Central Station Service				Class "B"—Combined Isolated Plants and Central Station Service							Class "C"—Isolated Plants				
		No. Customers	Kw. Light	Hp. Motors	Kw. Heating	No. Customers	Central Station Service Kw. Light	Central Station Service Hp. Mtrs.	B.-Hp.	Eng. Hp.	Gen. Kw.	Est. Hp.-Hr. per Year	No. Customers	B.-Hp.	Eng. Hp.	Gen. Kw.	Est. Hp.-Hr. per Year
1	Apartment houses	32	526	1,111									1		(b) 10		1,092
2	Artisans, craftsmen	11	19	118									3		(b) 29		3,000
3	Autos, accessories and rep.	153	444	1,626	27.5	3	26	14		(b) 75		6,500	1	450	300	264	345,000
4	Badges, buttons, etc.	2	6	30									2	450	340	125	37,800
5	Bakers and confectioners	199	348	2,481	173	4	54	285	875	325	30	702,000					
6	Barbers' supplies	2	1	2													
7	Beds and bedding	18	43	524	40								1	125	120	75	104,000
8	Blacksmith and wheelwright	15	8	84													
9	Boilermakers	2	8	290													
10	Brooms, brushes	16	62	334		1	55		400	225	135	208,000					
11	Builders, contractors	8	41	116		2		13		(b) 11.5		1,560					
12	Butchers	16	23	370		2	7	72	290	120		218,400	5	230	78		66,600
13	Canners, packers	52	223	3,421		28	266	3,515	8,905	3,537	495	8,222,000	17	4,897	(a) 15 1,560	307	1,934,000
14	Carpet cleaning	4	8	105									2		(a) 18		3,000
15	Chemicals, drugs	32	197	2,653	20								4	13,350	4,662	2,052	10,260,000
16	Clay industries	5	35	1,085		2	2.5	105	800	600	6	700,000	8	1,910	990		1,118,000
17	Cleaners and dyers	9	15	249									3	415	240	10	162,500
18	Clothing industries	159	585	2,246		2	36	14	220	160	100	14,000	2	865	(a) 22 588	350	653,000
19	Clothing accessories	39	100	281		3	4	4	265	(a) 15 65	2	89,500	3	1,690	1,240	760	772,800
20	Coal and wood yards	32	10	139									5	230	(a) 7.5 150	20	424,000
21	Coffees and teas	30	70	521									1	60	40		40,000
22	Commission merchants	8	4	30		1	1	6		(a) 12		2,500					
23	Creameries and dairies	43	171	2,112		3	5.5	58		(a) 62		90,000	1	15	5		10,000
24	Department stores	19	373	552		2	339	461	1,250	1,280	625	748,800	4	3,050	3,055	1,775	3,725,300
25	Electrical contrs., etc.	35	661	1,677	300	1	70	315	4,300	5,000		17,472,000	1	225	150	104	260,000
26	Electrolytic works	1	500	31,790	500												
27	Elevators	4	5	102		1	2	148	80	50		59,500	2	300	(a) 10 125	6	237,500
28	Fertilizers	16	551	18,937									5	1,030	1,226	379	1,785,000
29	Grain, flour, feed	26	140	2,429	17	1	45	855		(d) 400	330	421,200	2		(a) 8 (d) 22		19,600
30	Glass industries	6	75	1,127		1	4	144	300	295		452,400					
31	Hotels	13	561	1,058		2	160	352	900	720	335	682,000	1	600	405	170	873,000
32	Ice cream mfgrs	19	36	2,124									1		(a) 6		5,000
33	Ice plants and refrig	15	49	5,885		7	13	426	4,830	GP 115 (c) 300 2,569	450	9,007,000	8	4,790	4,585	655	19,852,000
34	Jewelers and opticians	8	13	26		2	18	92	300	210	103	175,000					
35	Laundries	33	36	244		6	11	56	815	275		308,800	15	2,150	1,265	310	1,203,100
36	Leather industry	14	31	114		2	9	254	300	(a) 15 35		68,700	4	400	(a) 17 240	40	214,000
37	Liquors, spirits, etc	38	60	1,276		4	40	298	5,075	(a) 7 1,182	227	2,532,500	11	5,915	1,721	360	1,050,000
38	Lunchrooms	15	41	98	25												
39	Machine shops, etc	74	118	1,181		10	16	282	510	GP 27 (a) 66 305	5	435,000	15	405	(a) 134 262	18	519,000
40	Metal industries	98	1,573	32,484	10,869	23	548	7,712	4,887	(a) 105 2,766	1,102	2,577,000	17	1,682	(a) 113 (c) 60 1,279 (b) 21	645	1,624,500
41	Miscellaneous	46	337	658		4	128	458	230	143 (a) 10	74	188,000	4	437	328	192	376,600
42	Musical instruments	4	51	510		1	20	8	300	150	86	125,000					
43	Offices	51	757	1,236		1	200	42	300	100		125,000	9	4,670	2,807	1,820	4,256,000
44	Oils and greases	16	232	998		8	68	1,199	4,757	(a) 10 731		3,441,300	1	8,000	2,550	1,600	8,636,000
45	Paints and pigments	15	19	267		1	8	88	150	135		112,000	4	175	(a) 19 115	25	226,000
46	Paper industry	45	113	1,574		4	31	132	300	(a) 39 150	80	216,000	4	80	(a) 30 50		124,500
47	Photographers	2	31	1.25													
48	Physicians and dentists																
49	Plumbers	2	16	77		1	36	11	100	100		125,000					
50	Printing industry	141	545	3,651		5	37	563	360	(a) 22 295	140	328,000	6	820	(a) 22 720	535	557,600
51	Public bldgs. and insts	142	3,588	3,077	388	8	85	232	3,340	1,000	460	951,000	17	9,750	(a) 2 (c) 20 5,040	2,890	3,800,000
52	Pumps and pumping stations	20	86	5,205		5	4	256		(a) 55 (b) 246 (d) 500		89,250	8	3,400	(b) 41 (d) 400 5,635	730	14,996,000
53	Railroads and railways	*25	598	31,283		3	225	6,671	3,150	2,048		1,804,800	2	1,000	900	637	326,200
54	Rubber industry	24	46	759		1	6	11	60	30		35,750	1	55	35	5	13,500
55	Shipbuilders and shipyards	14	870	16,160		3	7	249	470	305		28,000	3		(b) 77		106,800
56	Shoemakers and repairs	267	166	895									1	125	70		108,000
57	Soap and starch	1	2	25													
58	Spices	3	259	986													
59	Stables	4	16	68													
60	Stone, concrete, etc	54	66	4,006		7	17	545	1,975	970		2,449,000	14	1,100	(b) 11 914	10	1,075,000
61	Stores	183	864	1,912		1	2	10	60	40		25,000	1		(a) 6		6,000
62	Supplies	30	68	369		1	3	8	275	325	225	187,200	3	170	(b) 65 155		237,000
63	Tailors	108	114	297													
64	Telephone and tel. sta.	4	268	298													
65	Textile industry	26	275	7,488		3	90	1,349	1,890	(d) 1000 1,725	18	3,030,000	12	4,156	(a) 30 (d) 2,000 5,225	3,215	10,176,200
66	Tobacco	10	63	282									3	1,400	995	580	600,000
67	Toys	11	80	442													
68	Umbrellas	5	26	56											(a) 15		
69	Unclassified	48	314	1,946		6	19	263	700	(a) 30 268	110	538,750	12	10,139	(b) 4 9,615	6,845	30,106,390
70	Wagon works	23	25	287									1		(a) 8		6,000
71	Warehouses, etc	62	394	1,153		1			200	200		140,400	2	360	275	100	618,000
72	Woodworking	92	618	12,227		21	96	835	2,790	(a) 88 2,017	27	2,901,900	23	4,845	(a) 73 3,885	550	5,669,000
73	Yeast Mfg	3	34	459		2	15	1,525	2,350	870	510	5,705,000					
						1	40a	60,335	20,200	66,980	20,000	144,000,000					
	Total	2,802	18,710	219,684	12,578	201	3,282	90,267	79,259	101,432	25,681	211,740,710	276	95,916	66,233	28,059	129,378,582

NOTE: Class "B" engine horsepower total 101,432 consists of steam 31,241; gas engines, 536; gasoline, 333; oil, 300; waterwheels, 1,900; gas producers, 142 Bethlehem Steel steam and gas, 66,980. Class "C" engine horsepower total 66,233 consists of steam 63,940; gas engines, 533; gasoline, 258; oil, 80; waterwheels, 2,422.

40a—Cenral station load and number of motors counted as one-half actual installation.

Prime movers other than steam are indicated as follows: (a) gas; (b) gasoline; (c) oil; (d) waterwheel.

* Number of locations.

rounding territory within a radius of approximately ten miles and beyond was included to secure data on all commercial and industrial applications for power and fuel within the territories reached by our gas and electric lines, if they used, or might be regarded as prospects for the use of, gas and electricity. The entire territory was divided into nineteen sections, an attempt being made to make these sections fairly equal in regard to the work assigned. The members of both the industrial power and industrial fuel departments were engaged on this census, a section being assigned to one man, who collected data in that section for both gas and electric installations.

Plants containing large installations with which some member of the power or fuel departments was particularly familar were listed. Such plants were not canvassed by the man working the section unless they were specifically assigned to him. Lists were furnished showing to whom these plants were assigned, and the man who was listed as assigned to those plants was responsible for the electric data and the fuel man for the gas data. On these reserve lists the names of a power and fuel man respectively were shown. The man whose name was shown with an asterisk was to work up the data, consulting with the man not so marked. Where both men were marked, one prepared the power data and the other the fuel data.

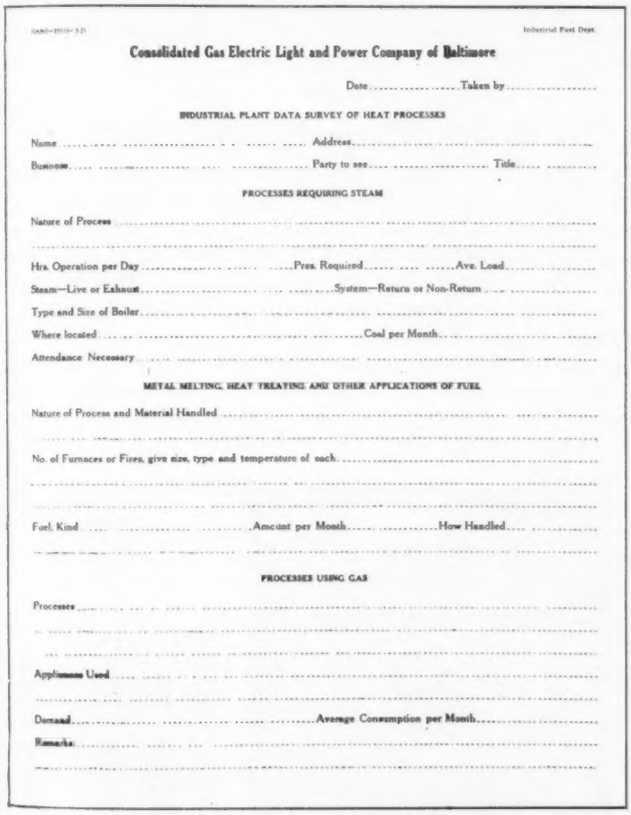
Full instructions in writing were given to each man, covering both the general method of approach and attitude, and explaining in detail the nature of the answers he should secure to the questions on the sheets or rather to the data indicated as desired. These sheets are reproduced herewith. The result of the entire census, giving in detail the percentage of electrification of each industry and the percentage of the power supplied by the central station in each industry, is shown in Table IV. From this sheet also we find the data for the Class A customers, those using exclusively central-station service, as shown in Table V.

Of the 476 isolated plants, Table VI, the census showed that 83 were gas engine installations on the company's gas service, leaving 394 plants, of which 360 were steam. Their division as to prime movers is also shown in Table VI.

With reference to the matter of load factor, by deducing from the December, 1922, income statement the amount of industrial power sales and dividing by the figure of horsepower connected, as shown in Table V, we obtain the figure of 1,120 kw.-hr. per horsepower connected, or a load factor of 17.1 per cent. This is somewhat lower than the 22.3 per cent load factor of isolated plants, and may be partly accounted for by the larger average size of prime movers.

Based on the company's output for December, 1922, and omitting the Bethlehem Steel Company, it was found that the estimated isolated plants' output amounted to 25 per cent of the central-station company's output. In other words, the Baltimore company supplied 80 per cent of the total power used in Baltimore and vicinity, as compared with 57 per cent shown by the statistics of the country as a whole.

Calculations were made showing what effect 100 per cent central-station saturation of the entire territory would have on our connected load, although it was realized that due to certain physical factors and locations favoring the isolated plant, a certain portion of this business could not be considered an immediate prospect for central-station service. Instead, a figure of 75 per cent was used as being a more accurate gage. For instance, approximately 100,000 hp. in isolated



Industrial Fuel Dept.

Consolidated Gas Electric Light and Power Company of Baltimore

Date..... Taken by.....

INDUSTRIAL PLANT DATA SURVEY OF HEAT PROCESSES

Name..... Address.....

Business..... Party to see..... Title.....

PROCESSES REQUIRING STEAM

Nature of Process.....

Hrs. Operation per Day..... Pres. Required..... Ave. Load.....

Steam—Live or Exhaust..... System—Return or Non-Return.....

Type and Size of Boiler.....

Where located..... Coal per Month.....

Attendance Necessary.....

METAL MELTING, HEAT TREATING AND OTHER APPLICATIONS OF FUEL

Nature of Process and Material Handled.....

No. of Furnaces or Fires, give size, type and temperature of each.....

Fuel, Kind..... Amount per Month..... How Handled.....

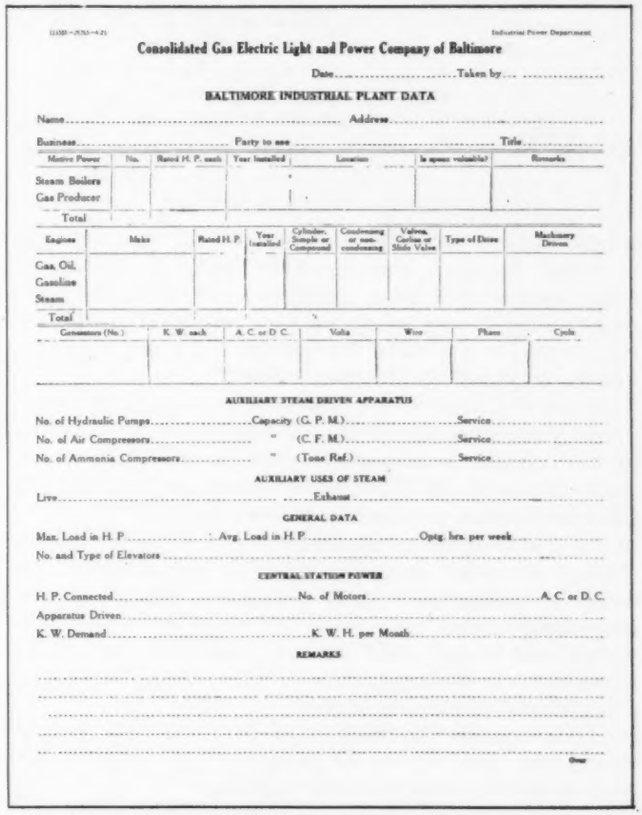
PROCESSES USING GAS

Processes.....

Appliances Used.....

Demand..... Average Consumption per Month.....

Remarks:.....



Industrial Power Department

Consolidated Gas Electric Light and Power Company of Baltimore

Date..... Taken by.....

BALTIMORE INDUSTRIAL PLANT DATA

Name..... Address.....

Business..... Party to see..... Title.....

Motive Power	No.	Rated H. P. each	Year Installed	Location	Is space valuable?	Remarks
Steam Boilers						
Gas Producer						
Total						

Engines	Make	Rated H. P.	Year Installed	Cylinder, Simple or Compound	Condensing or non-condensing	Valves, Corliss or Slide Valve	Type of Drive	Machinery Driven
Gas, Oil, Gasoline								
Steam								
Total								

Generators (No.)	K. W. each	A. C. or D. C.	Volts	Wire	Phase	Cycle

AUXILIARY STEAM DRIVEN APPARATUS

No. of Hydraulic Pumps..... Capacity (G. P. M.)..... Service.....

No. of Air Compressors..... " (C. F. M.)..... Service.....

No. of Ammonia Compressors..... " (Tons Ref.)..... Service.....

AUXILIARY USES OF STEAM

Live..... Exhaust.....

GENERAL DATA

Max. Load in H. P..... Avg. Load in H. P..... Optg. hrs. per week.....

No. and Type of Elevators.....

CENTRAL STATION POWER

H. P. Connected..... No. of Motors..... A. C. or D. C.

Apparatus Driven.....

K. W. Demand..... K. W. H. per Month.....

REMARKS

Over

FIELD DATA SHEETS USED IN TAKING INDUSTRIAL LOAD CENSUS

TABLE V—CUSTOMERS USING CENTRAL-STATION SERVICE EXCLUSIVELY

Total number of power customers, counted	3,003
Total industrial lighting connected, kw	21,992
Total industrial power connected, hp	326,722
Number of motors	18,049
Average size of motor, hp	17.15

TABLE VI—ISOLATED PLANTS*

Number of plants	476
Total horsepower prime movers	100,685
Estimated horsepower-hours output per year	197,119,292
Equivalent kilowatt-hours output per year	147,000,000
Equivalent kilowatt-hours output per month	12,250,000
Kilowatt-hours per year per horsepower prime mover	1,460
Load factor, per cent	22.3

Division of Prime Movers

Number of Plants	Kind	Horsepower Prime Movers
360	Steam	95,181
83	Gas	1,069
24	Gasoline	591
3	Oil	380
4	Water wheel	4,322
2	Gas producers	142
Total 476		100,685

*Omitting Bethlehem Steel Company waste gas engines.

In comparing these results with those of the 1913 census it should be borne in mind that the latter covered only city territory, an area at that time of approximately thirty-five square miles, while the census of 1923 covered a wider radius and included a territory of approximately four hundred square miles.

plants was shown by the census; 75 per cent of this, or 75,000 hp., was considered as easily probable new central-station business. With this added to the company's lines, it was estimated that an additional 26,000 kw. would be added to the station load and approximately 9,400,000 kw.-hr. per month.

In practice some of the uses of the census have been:

(*a*) From the Class A and B subdivisions, the figure of the company's connected industrial load was made.

(*b*) From the B and C subdivisions are obtained the total amount of prospective power business.

(*c*) The department members, who have made special studies of certain specific industries, are assigned the work of seeing that these respective industries are thoroughly worked, a complete test made and report submitted and every effort used to persuade owners to abandon their isolated plants in favor of the more economical central-station service.

(*d*) From the lighting data given in the census sheets, the most favorable prospects are selected and worked by industrial lighting specialists.

(*e*) In ratifying changes from isolated plants to central-station power, B or C sheets, as the case may be, are extracted from the file, a new sheet bearing the new data is made and attached thereto, and both are refiled in the A group.

(*f*) The tabulation of the three classes, at any desired six months or yearly period, shows the status of local industrial power at that time. Based on contracts made since January, 1923, the time of the last regular ten-year revision, and including the 1924 results, the census now shows the following prospective industrial business served by private power plants in Baltimore and surrounding territory as of Jan. 1, 1925:

Number of plants	301
Total horsepower prime movers	89,083
Estimated horsepower-hours output per annum	154,989,860
Equivalent kilowatt-hours per annum	116,242,395
Equivalent kilowatt-hours output per month	9,686,866

(*g*) The census has been a material aid in planning estimates of expansion in distribution equipment.

(*h*) The census shows the immediate uses and possibilities in the replacing of industrial power by more economical sources; in discovering new and more widespread applications.

(*i*) It affords a means of arriving at a tentative basis of comparative cost and of directing the test layout before the test equipment is installed.

(*j*) It shows the volume of business available as compared with that already contracted for.

(*k*) It serves for the study of various types of loads and the finding of load factors, etc.

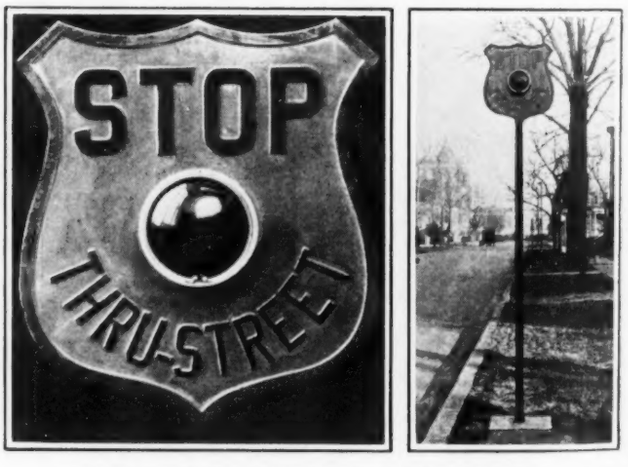
(*l*) It assists in forecasting the goal that may be expected in our community and territories adjoining in any specific direction.

(*m*) It serves as an aid in directing our efforts to obtaining the most attractive business for the company.

(*n*) It is planned to make resurveys at regular ten-year intervals so that the tabulated summaries will enable the company to take stock of its power business and possibilities at these periods.

Electric Through-Street Signal

IN 1924 the Chicago City Council appropriated $125,000 from the vehicle tax fund to be expended for the purpose of installing illuminated street and warning traffic signs and signals at the intersection of through streets. Prior to this appropriation trial installations consisting of about twenty different makes of illuminated "Stop, Thru Street" signs were made and a careful study made of the visibility, reliability, effectiveness and economy of construction, maintenance and operation. As a result of this work an illuminated sign, shown below, in the form of a shield with an illuminated lens in the center was adopted as a standard illuminated stop sign for this purpose. The shield was made of cast-aluminum alloy with a chrome-yellow baked enamel background and raised black baked enamel letters and border. In the center of the shield is a 6-in. ruby glass lens supported by raised glass cylinder, forming a complete weather inclosure for a 60-cp. series burning 6.6-amp. incandescent lamp. In addition to furnishing the light behind the red bullseye, the lamp serves to light the letters and face of the sign through the white glass of the cylinder. The sign is supported on a 2-in. iron pipe to give a mounting height of 8 ft. from the ground to the center of the bullseye.



TRAFFIC STOP SIGNAL USED IN CHICAGO

Electrical energy is furnished from transformers connected to the street-lighting circuits. Renewals and

maintenance are performed by the street-lighting system organization. Between August and December, 1924, a total of 665 of these signs were installed and placed in service, at a cost of $123 per sign, about 55 per cent of which went for labor and the rest for material.

Letters from Our Readers

Overmotoring on Polyphase Circuits

To the Editor of the ELECTRICAL WORLD:

The letter by Charles R. Underhill in your September 5 issue, commenting on E. N. Dittenhofer's article in the August 22 issue of the ELECTRICAL WORLD, draws further attention to and emphasizes the increasing seriousness of the overmotoring situation on polyphase circuits. It is difficult to estimate today the enormous waste which is going on all over the country due to the indiscriminate use of low-resistance squirrel-cage motors on polyphase circuits. The use of power-factor-corrective apparatus, whether synchronous motors or static condensers, will always provide a solution for an aggravated complaint, but most men installing new motors today would certainly rather use a little judgment and try to motor their machines so that the use of expensive corrective apparatus will not be necessary or will be required only in a smaller degree.

J. C. Hobart, in an article in the ELECTRICAL WORLD of March 14, estimated that there is in this country an excess investment in generating plant and cables of more than one-quarter of a billion dollars directly attributable to the overmotoring of industrial plants supplying the wattless component to polyphase motor circuits on underloaded motors.

Those of us who are familiar with European practice have always wondered why practice on the two sides of the Atlantic is so radically different. The Europeans have never allowed large squirrel-cage motors to be put on their lines, and one sees all over Europe slip-ring motors in almost universal use in sizes down to 5 hp. The reasons for this are simple: The Europeans have never believed in the compensator and have not been able to put squirrel-cage motors directly on the line without compensators, because most of their power stations are small and they would never permit the use of a motor drawing starting currents—which is quite common practice with us.

Fortunately a type of motor has been available for a number of years and is manufactured by several firms in this country the advantages of which are becoming more and more appreciated. The automatic self-starting motor, to which reference is made, is not an experiment, having been known and sold almost as long as the low-resistance squirrel-cage motor. It has been made by different manufacturers in different forms, but the design has become pretty well standardized now into a motor having a high-resistance alloy-welded end-ring rotor winding in conjunction with a low-resistance phase winding, which is brought out to three points and short-circuited by a centrifugally operated three-point switch. This, the best type of motor, is entirely inclosed and dustproof.

All question as to the satisfactory operation of a centrifugal switch has been settled as a matter of history. Today, as these motors are manufactured, the operation of the switch is more certain and more foolproof than that of any other part of the motor. This has been the universal verdict from those who have had experience with modern automatic centrifugal switching devices. In the early days the design of these automatic switching devices was defective, and hence some trouble was experienced.

This motor is now installed where in the past a slip-ring motor would have been used. It is cheaper in first cost than the slip-ring motor, runs at an equal power factor and efficiency, has all the valuable starting characteristics of the slip-ring motor and is without the disadvantages of a cumbersome separate starting device. The slip-ring field today is confined to applications where speed variation or rapid and frequently reversing service is necessary.

Many instances have come to the writer's attention where remarkable savings in first cost and high power factor during the starting period have been obtained by the substitution of these motors for the old low-resistance squirrel-cage drive with compensator. It would appear, indeed, that the day of the latter is virtually over, except in special cases, and while it is true that some intermediate types of motors have appeared, such as the revived Boucherot double squirrel-cage motor, there is really no competitor today with the standard self-starting, high-resistance, high-power-factor, high-efficiency motor. F. I. HISS.

Cincinnati, Ohio

Power-Factor Improvement

To the Editor of the ELECTRICAL WORLD:

In your issue of October 3, page 699, you publish a letter from H. L. Cape of Birmingham with reference to power-factor improvement in this country. I do not think that the statement contained in the last two paragraphs should go unchallenged or be taken in any way as representing the knowledge or ability of the responsible plant men in this country.

I would point out that the question of power factor probably received attention far earlier in this country than in any other part of the world. At least one of the large power companies operating over a large industrial area adopted the kva. demand charge from the first, and this is undoubtedly the biggest incentive to power-factor improvement. Irrespective of this, the writer is well aware of the very extensive consideration which has been given to power-factor improvement by groups of collieries and other private undertakings. In such cases the improvement has been undertaken chiefly for transmission and regulation requirements, and on numerous colliery plants an average power factor better than 90 per cent lagging is regularly obtained.

The subject is of great importance, and I should like to take this opportunity of thanking you for the large number of valuable articles dealing with it which have appeared in your pages during the past few years. R. M. LONGMAN.

Leeds, England.

Is This a World's Record?

To the Editor of the ELECTRICAL WORLD:

The *Elektrotechnische Zeitschrift* reports that the electric power station at Zschornewitz, belonging to the Electrowerk Gesellschaft, which has a total capacity of 140,000 kw., recently succeeded in achieving a daily output of 3,000,000 kw.-hr., which it claims establishes a world's record. Is this true? C. J. W.

London, England.

Central Station and Industrial Practice

Street-Lighting Control for Subway Installations

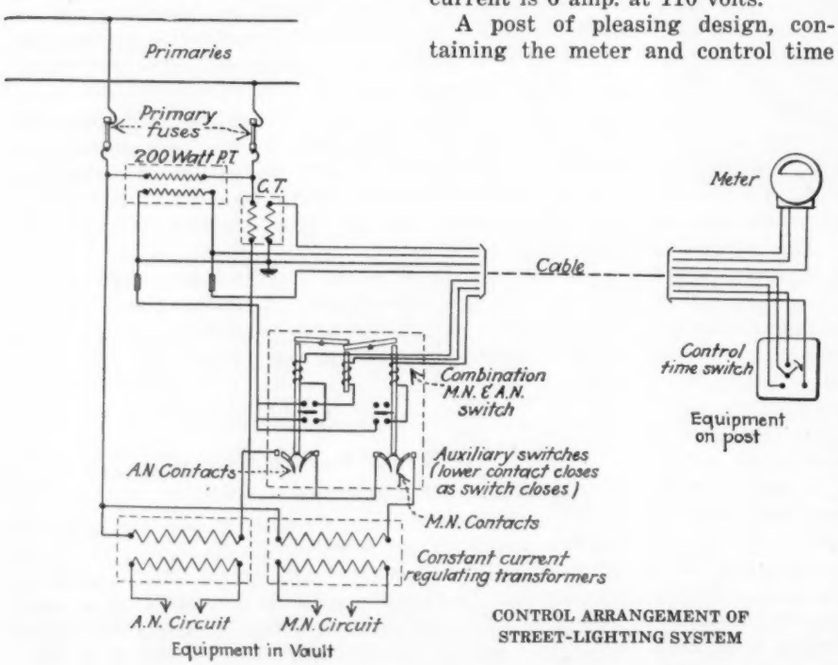
BY O. W. HOLDEN
Junior Electrical Engineer, Bureau of Power and Light, City of Los Angeles

WITH the tremendous demand for service to new series post lighting systems, the Bureau of Power and Light of the City of Los Angeles has developed a control scheme for use in underground districts into which, due to isolation or insufficient development, it was undesirable to carry a station-controlled underground street-lighting primary. The scheme is shown diagrammatically in the accompanying sketch and consists essentially of a low-voltage time switch controlling a solenoid-operated combination all-night and midnight high-voltage switch. The control time switch, which, together with the meter, is installed in an accessible post, is of an ordinary commercial type reconstructed so that three contacts are made in rotation, the contact arm tripping from each point to the next at set times. The combination switch, which is installed in a vault with the regulating transformers, contains three solenoid coils and two independent sets of main contacts so arranged that the operation of the middle coil simultaneously closes both the midnight and all-night contacts. Each contact may then be individually opened by the action of its particular side coil.

The solenoid circuits are closed by the control time switch, but are broken by means of auxiliary switches, which are tripped as the solenoids operate by quick break attachments on the solenoid rods. Thus no energy is used except during the actual movement of the switch, a feature that permits the use of a common potential transformer by both meter and switch control, as the meter registration is not appreciably affected by the momentary overload on the transformer. The combination switch, as well as a single-contact switch for all-night service, was developed by the Bureau of Power and Light because of the absence of a suitable device on the market. It is rated at 5,000 volts, 25 amp., and the maximum initial rush of solenoid operating current is 6 amp. at 110 volts.

TIME SWITCH POST
Contains meter and control time switch

A post of pleasing design, containing the meter and control time switch, is placed at the curb convenient for meter reader and switch maintainer.



CONTROL ARRANGEMENT OF STREET-LIGHTING SYSTEM

Impregnating Windings with Synthetic Resins

IT IS KNOWN that synthetic lacs and resins are artificial products based on fornol or phenol. In their initial state these products are soluble in alcohol and can therefore be easily injected. If these products are subjected to a certain temperature, they come to an intermediary state where they are still fusible and then reach a final state where they have a structure similar to wood.

In this state they are non-burning and begin to carbonize a little only at temperatures much higher than are usually reached in electrical apparatus. They are also neutral and are not affected by hot oil, acids or alkalis. The dielectric strength is then equal to China lac. They are thought to be an exceedingly good material for insulation of motor windings, slots of armatures, transformers, etc., but the development of special equipment, which in particular would allow control of the shrinkage and produce the evacuation of gases, has been necessary.

A new method of doing this has been developed in France. Two stoves are provided and the process is as follows:

The first stove completes the drying of the apparatus or parts under a vacuum of 700 mill-in. of mercury and at 100 deg. C. The operation lasts from two to four hours, depending on the kind of material or windings.

The parts are then taken off the first stove while heated and placed in the second stove, which is cold. A vacuum is obtained and lac is drawn into the stove so as entirely to surround the windings or parts to be impregnated. Then the vacuum is removed and impregnation pressure of from 4 to 6 kg. is put on without heating.

The lac is driven from the stove by compressed air and drying is started by heating until the windings cease to exude. This operation lasts about two hours.

The parts are then taken into a

stove similar to the first, called the polymerizor, where the temperature is brought up to 135 deg. C. at a pressure of from 2 to 6 kg. After from two to four hours the material can be taken off, completely impregnated and covered with a hard and solid lac.

Some tests have been made for the French navy with the following results:

1. A coil made of 1 mill-in. wire covered with two layers of cotton and one layer of oilcloth around the whole coil was treated by the process mentioned and was tested at 3,000 volts for one minute. It was then immersed in sea water under a tension of 120 volts. After nineteen days the coil supported 1,000 volts when tested in mercury. No coil treated by any other process has ever exceeded eight days under these test conditions.

2. A motor treated by this process has run more than 500 hours completely immersed in salted water and is still running under these conditions.

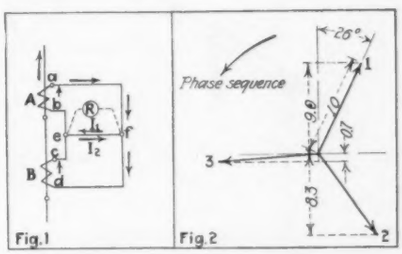
Transformer Relay Connections

Differential Relay Connections on Delta-Star Transformer Banks Shown by Instantaneous Current Diagrams Instead of Vector Diagrams

BY WILLIAM S. SCHMIDT
Operating Department Engineer, Penn Public Service Corporation, Johnstown, Pa.

IN DIFFERENTIALLY protected transformers we make use of the fact that under normal operation the current in the primary winding has an almost fixed relation to the current in the secondary; this relation of currents is changed when internal trouble exists. This change in relation destroys the normal current balance in the relay circuits, with resultant relay operation and de-energizing of the transformer.

If two separate current transformers are connected as shown in Fig. 1 and the currents are equal and in phase, the current in the wire *ef* will be zero. Hence if we replace the wire *ef* with relay *R*, no current will flow through the relay, so long as the currents in *A* and *B* are equal. If the current in *A* becomes larger than the current in *B*, the excess current will flow through the relay connected from *e* to *f*, as current transformer *B* will try to keep the current flowing through its winding at the normal amount.



DIFFERENTIAL RELAY CONNECTIONS ON DELTA-STAR TRANSFORMER BANKS

Fig. 1—Diagram of simple differential relay connections.

Fig. 2—Vector diagram of instantaneous currents on star side of the transformer, assuring maximum current of 10 amp.

In protecting a single transformer with differential relays the problem is similar to that shown in Fig. 1, except current transformers of the proper ratio must be used so as to give the same secondary current. This simple relation does not exist in the delta-star connected bank of transformers, due to the 30 deg. phase difference between the currents in the primary and secondary line wires. To compensate for this phase displacement the current transformers on the delta side of the bank should be connected in star and those on the star side of the bank should be connected in delta. It then becomes a question as to how the two sets of current transformers should be connected so as to bring their currents in phase and allow the proper circulation of their normal current.

METHOD OF DETERMINING VALUES OF INSTANTANEOUS CURRENTS

To simplify the problem, let us assume that the power and current transformers have a 1 to 1 ratio. Then assume instantaneous currents in the three wires on the star side of the bank, and from these determine the instantaneous currents in the other parts of the system. In a three-phase system the sum of the instantaneous currents is zero. Assuming an instantaneous maximum current of 10, the currents in the three phases shown in Fig. 2 will at that instant be equal to + 9 in phase 1, — 8.3 in phase 2 and — 0.7 in phase 3. Applying these values of current to the problem in question, giving the direction of current in phases 2 and 3 as opposite to that assumed in phase 1, we can then treat our problem as in a direct-current network.

In subtractive polarity transformers, the instantaneous flow of currents in the primary and secondary winding is in the opposite direction. In additive polarity transformers, the instantaneous flow is in the same direction.

When the direction and values of instantaneous currents in the windings of the power transformers have been determined, it will be found that the currents in the wires from the delta side are different in value from those on the star side, but due to the delta connection of the current transformers we find, if the delta is correctly made, that the

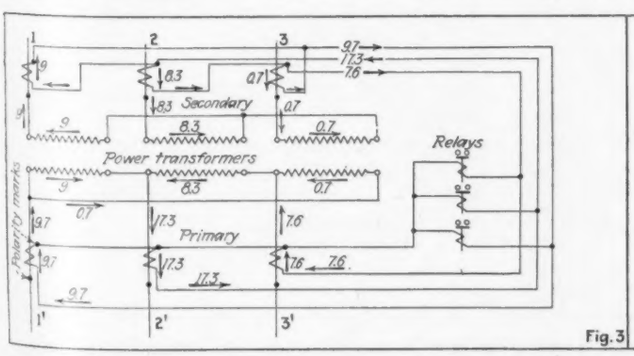


FIG. 3—INSTANTANEOUS CURRENT DIAGRAM FOR DELTA-STAR BANK OF SUBTRACTIVE POLARITY TRANSFORMERS

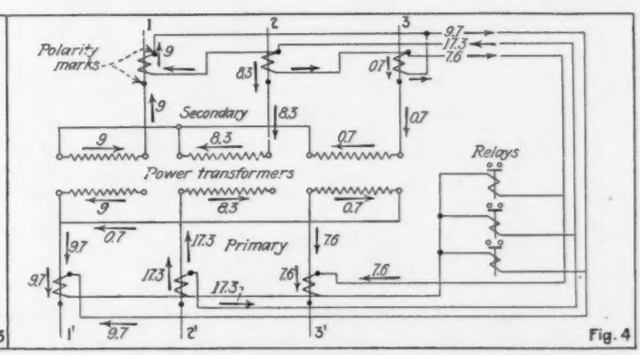


FIG. 4—SAME AS FIG. 3, EXCEPT NEUTRAL OF POWER TRANSFORMERS IS REVERSED

three currents coming from the one set of current transformers are equal to those in the other set, and the wires to be connected together are those having the same value of current. In actual practice, the ratios of the current transformers should be such as give the same current in their secondaries. This in many cases would require current transformers of special ratio, involving unusual expense. To overcome this, standard ratio transformers are used, but are connected to auxiliary current balancing transformers as shown in Fig. 6. These are connected so that the ampere-turns or magnetizing effect on the cores of the auxiliary transformers from one set of current transformers are equal and opposite to the other set. Hence under normal conditions the current through the relays should be zero. When internal trouble occurs, the current from one set will become larger than the other. This unbalance of ampere-turns in the coils will send a current through the relays and cause them to operate.

In the example shown in Fig. 6, it has been assumed for the sake of clearness that the power transformers are of 3 to 1 ratio and the current transformers of 1 to 1 ratio.

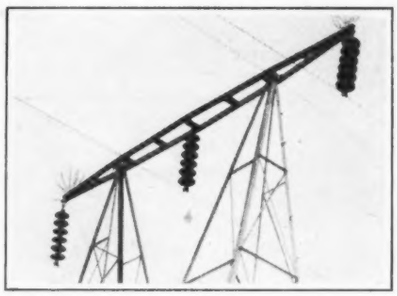
Although not strictly correct, it is a little easier to use + 9, — 8, and — 1 as instantaneous values of current in phases 1, 2 and 3 respectively, instead of + 9, — 8.3 and — 0.7.

POWER-FACTOR METER USED TO CHECK CONNECTIONS

The Penn Public Service Corporation has also made use of a single-phase power-factor meter with a 360 deg. scale as a simple means of checking the connections in the field. The potential coil of the meter is connected to the same alternating-current source during the test. The current coil is then connected in series with the various wires and the phase displacement read on the meter. Those currents that are 180 deg. apart should then be connected together to give the proper flow of normal circulating current.

Bird Guards Prevent Flashovers on 130-Kv. Line

SOME trouble with flashovers caused by birds was experienced by the Montana Power Company until bird guards were installed on the towers. Owls have a habit of perching on the ends of the upper tower members above the outer conductor and watching for prey. In taking off from the tower they frequently leave a string of dirt which sufficiently bridges the gap between the conductor and the tower to cause a flashover.



STEEL WIRE BRUSHES ON TOWERS PREVENT BIRDS FROM CAUSING FLASHOVERS

The trouble has been overcome by installing a stiff wire brush on each end of the upper tower member. The brushes consist of a dozen steel guy wire strands about a foot long set into a metal cup filled with solder or wiping metal. The whole arrangement is fastened to the tower member by a bolt previously set in the bottom of the cup and may be installed at a small cost. This provides a highly uncomfortable perch for our feathered friends. No further trouble has been experienced on towers where these guards have been installed.

Demand-Meter Installation

PRACTICES of several large utilities in installing demand meters have been studied by the Great Lakes meter committee of the N. E. L. A. (J. E. Miller, chairman). Except in two special cases, integrated and lagged demand meters are used exclusively. Sixty per cent of the companies reported that demand-meter installations were being made iron clad in the same way as the watt-hour meters. Seventy per cent use heating units of various types in cold weather. The ratings of these units range from 20 to 200 watts, the majority being about 20 to 30 watts. Twenty-five per cent use thermostat control.

All of the companies reported that the installation of demand meters is made and checked by specially trained men. Installation of the contactors is divided evenly, 50 per cent installing them after the watt-hour meter is installed and 50 per cent before or in the shop. Sixty per cent of the companies fuse the demand-meter circuits. One company fuses the circuit on direct-current installations only. Regarding the routine for installing contactors, one large company reported that the meters were installed by the regular meter installers, and cams and brushes by specially trained demand-meter men. Another large company reported that all contactors are installed by specially trained testers, who make an accuracy check of the meter before and after the contactors are placed on the meter. The installation test consists of observing the number of disk revolutions to advance the cam one tooth.

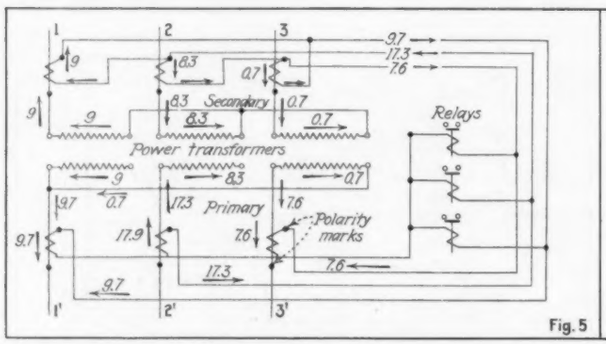


FIG. 5—CONNECTIONS FOR DELTA-STAR BANK OF ADDITIVE POLARITY TRANSFORMERS

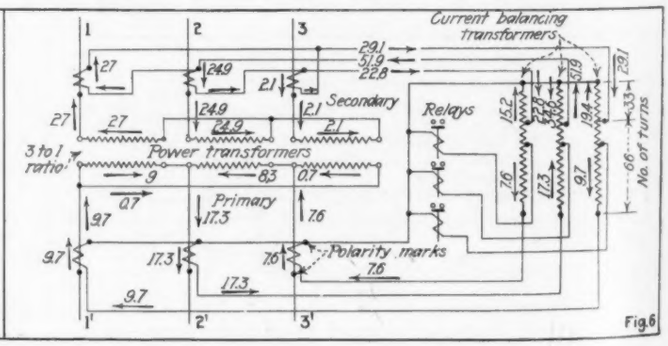


FIG. 6—CONNECTIONS WHEN AUXILIARY CURRENT BALANCING TRANSFORMERS ARE USED

Commercial Activities and Public Relations

Cities Adopt Codes

West Virginia Active in Code Work—Huntington and Logan Make Important Moves

A STATE-WIDE fire prevention campaign is being waged in West Virginia, and an important element in this work deals with electrical codes and inspections. State Fire Marshal C. L. Topping states encouraging progress is being made.

The more recent action in this direction was the adoption by Huntington city commissioners of a new electrical code recommended by the fire prevention bureau of the Chamber of Commerce, and creation by city commissioners of Logan of a municipal office having to do with a closer inspection of electric wiring and plumbing, and the general overseeing of building construction in the interest of fire protection.

The Huntington code provides for appointment by the West Virginia inspection bureau of a full-time electrical inspector for that city. In addition to adopting the code, the commission incorporated its salient provisions in the city building code, arming the city building inspector with authority to halt new construction that may be in violation of the electrical code. The code adopted by the city puts into effect the electrical inspection code of the National Board of Fire Underwriters.

All fines received from violators of the electrical code, the new law provides, shall be placed in the firemen's pension fund in the hands of the city treasurer. A fine of from $5 to $25 for each offense is provided, each offense being defined as continuation of failure on the part of a builder to comply with provisions of the code over a period of ten days or a fraction thereof.

"Defective electric wires the last fiscal year caused forty-five fires and a loss of more than $400,000," commented Fire Marshal Topping, who added that the origin of 407 of the 989 fires reported in the state that year was unknown and therefore the list of electrical fires was doubtless considerably short of actuality.

When a Utility Starts Merchandising

Objections to Policy Found Largely Imaginary—Good Merchandise, Maintained Prices and Aggressive Selling Increase Business for Both Utility and Electrical Dealers

An Interview with
J. W. DEVEREAUX
Assistant to the Vice-President in Charge of Operation, Byllesby Engineering & Management Corporation, Chicago

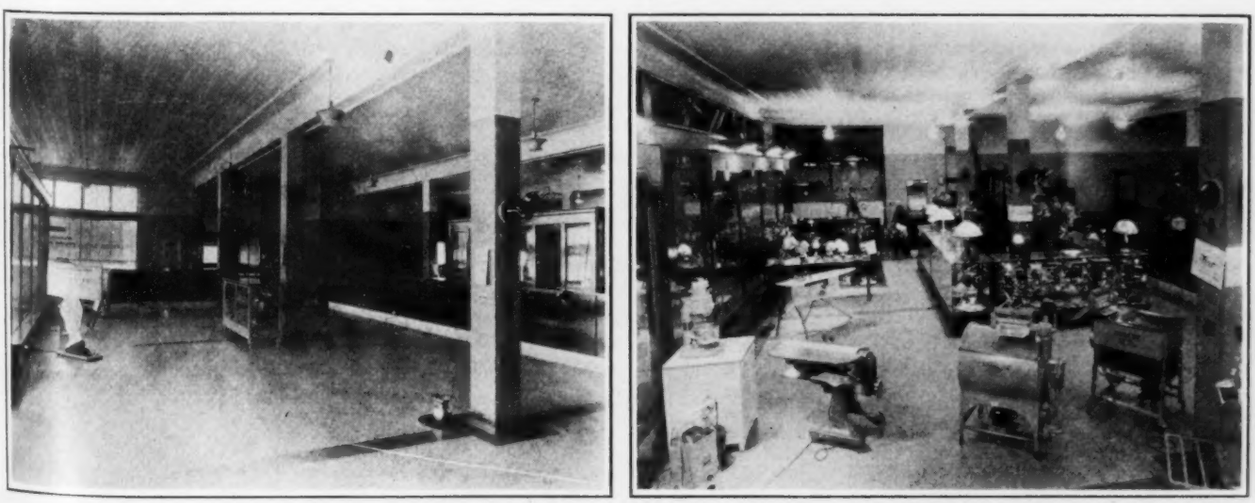
WHEN a utility operating throughout an entire state abandons an old policy of "no merchandising" and organizes an appliance sales department which builds up, within four months, a sales volume equivalent to one dollar per month per residence customer, the reasons back of such a change in policy and the methods employed merit careful study.

Such a transformation has taken place in the Oklahoma Gas & Electric Company. In an interview with a representative of the ELECTRICAL WORLD, J. W. Devereaux, assistant to the vice-president in charge of operation, Byllesby Engineering & Management Corporation, under whose supervision the new departure was inaugurated, tells of conditions surrounding the undertaking and some of the company's experience to date.

"Were there objections raised to your company's selling appliances? If so, how were they met?" Mr. Devereaux was asked.

OBJECTIONS TO APPLIANCE SALES IMAGINARY

"Our experience in Oklahoma has demonstrated that the objections to central-station merchandising are less real than imaginary," was Mr. Devereaux's reply. "The stock objections of some electrical dealers, that the utility should not sell appliances because it is a monopoly or that the utility should not enter a field already unprofitable because of competition, vanished like a mist when the public showed its approval by purchasing thousands of dollars worth of appliances and when the dealers themselves experienced a stimulation of their own business



AT LEFT—COMPANY'S OFFICE BEFORE ENGAGING IN APPLIANCE SALES. AT RIGHT—SAME OFFICE EQUIPPED AS SALESROOM

beyond anything they had ever known. And those men in the utility itself who were skeptical six months ago are today conscious of a quickening of the pulse of the entire organization, a new awakening of public interest in the utility and a volume of appliance sales, additional connected load and increased earnings that are as gratifying as they are surprising.

"But there may be sincere objections," continued Mr. Devereaux. "A question sometimes raised is, 'Will the utility maintain prices?' The utility that expects to hold the confidence of the local trade must be able to answer this question in the affirmative. Another fair question is, 'How much time will you give on deferred payment sales?' The dealers must be convinced that the same methods of financing time payment sales are available to the small dealer as to the utility. It should also be made clear that the power of the utility's greater working capital will be used in selling the electrical idea rather than in giving price concessions under guise of time payments."

Organizing to Sell

Asked how the new plan was put into effect, Mr. Devereaux said: "We want customers in Oklahoma to be able to enter one of our stores and to know at once that it is an Oklahoma Gas & Electric Company store. If such an atmosphere can be created, the benefits will be cumulative, as the company's customers move from place to place. Our first efforts toward this end were to secure a uniform show window. We have adopted a uniform valance, bearing the company's monogram. A uniform window-lighting layout is used, the reflectors being hidden from view from both the sidewalk and the sales floor. A portable background of uniform design has done much to stamp the window as an 'O. G. & E.' window.

"In arranging the floor displays an effort has been made to induce customers to pass as much of the display as possible on their way to pay bills or purchase lamps. Sidewall cases and glass showcases have been standardized and their arrangement made uniform throughout the stores.

"While on the subject of uniformity, it may be well to mention that a uniform method of appliance sales accounting is essential where a number of stores are to be operated."

The appliance sales department, as organized by Mr. Devereaux for the Oklahoma Gas & Electric Company, has a state sales manager and division chief salesmen. The state manager reports to the general manager of the company and supervises the work of the divisional units, which are a part of the company's divisional organization. The general appliance sales policies and schedule of activities are under the supervision of Mr. Devereaux. Orders for appliances originate with the local sales departments, but all orders are kept within an approved list of standard appliances that are well known and the manufacturers of which are responsible.

Capitalizing Opening Days

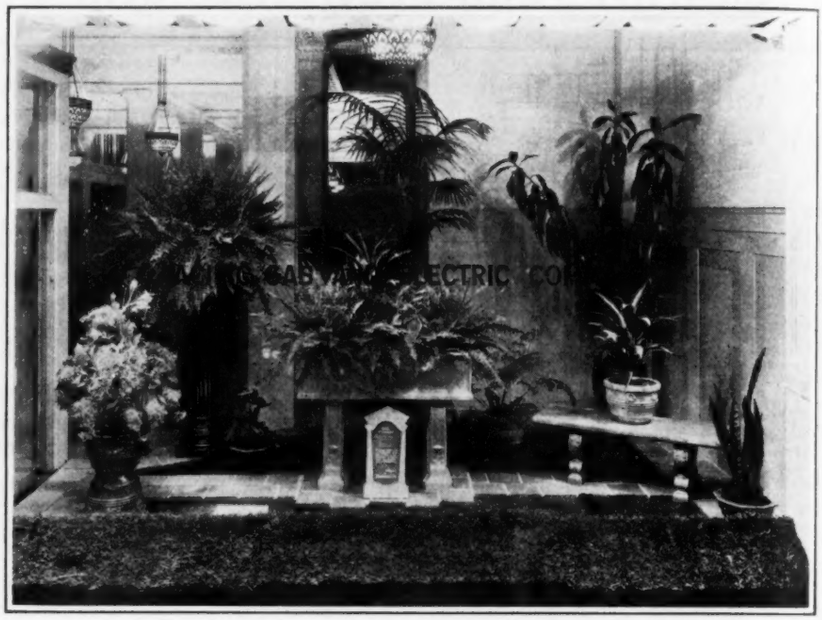
"Opening day for a new appliance store," said Mr. Devereaux, "offers a splendid opportunity to show the public and the local trade just how important a factor the store is to be in the life of the community. The occasion is utilized to display many appliances which, though beyond the purse of many families, do help to sell the electrical idea. Demonstrations of ranges, kitchen aids, sewing machines and numerous appliances that do much to popularize electricity are features of all of our store openings. In a town of 17,000 population more than 3,500 persons registered during ten hours of the opening day.

"On the evening of the opening day, campaign broadsides are in the mail. Salesmen are ready to start work the following day. All plans for the campaign are complete and designed to capitalize on the enthusiasm and interest created by the opening day program."

Asked what were the tangible results of the new policy, Mr. Devereaux said: "Tangible results during the past four months have been a volume of appliance sales equivalent to one dollar per month per residence customer in towns where stores have been opened, the total gross sales amounting to approximately $150,000. September sales in ten stores amounted to $53,350, or $1.22 per customer. Such an output of appliances must have its effect on the connected load and earnings of the company.

"But getting back to the objections

Commercial Customers Use Pacific Gas & Electric's Display Window



AS A MEANS of increasing interest in better window lighting among commercial customers the Pacific Gas & Electric Company has devoted one of its windows exclusively to the displays of other merchants. In this window, as shown in the accompanying illustration, the display of the customer, who in this case happened to be a florist, is arranged and the company's illuminating engineering department provides the most suitable lighting effects. This practice not only has resulted in the sale of better window-lighting equipment to merchants but has aroused a spirit of good-natured rivalry among commercial customers to provide the most attractive displays. Direct sales to people who have seen merchandise shown in this window have helped to convince many commercial customers of the value of window illumination.

and objectors. Not every dealer, as we knew, was in sympathy with the company's new policy. In one or two places we tried to convert these men to our view before we put our plan into effect. We found, however, that our best arguments and most earnest persuasion were as nothing compared with the effect produced by the actual opening of the stores. The success of the stores has been a practical demonstration of the fact that an appliance department of a utility can, instead of cutting into other dealers' sales, actually make two sales grow where one grew before. The day one of our stores opened, the largest bouquet received bore the name of the dealer we were told had been the most outspoken objector to our new plan. A month after one store had been in operation a dealer came in and asked what we were planning to campaign during the following month. We asked him why he was so interested. He replied that during the past month, when we had campaigned washing machines, he had sold twelve washers, more than he had ever sold in an equal length of time. 'How did you do it?' we asked. 'Oh', he replied, 'I just put the washers out on the sidewalk and sold them to people who were on their way to your store.' These dealers and dozens like them in Oklahoma have learned that the most powerful agency in a community for selling electric service and electrical appliances is a live appliance sales department in the local utility organization."

Aids to Developing Electric Truck Business

THE average electric truck in delivery service today is between two-ton and three-ton capacity and will use approximately 11,000 kw.-hr. per year, which at a rate of 3 cents per kilowatt-hour would bring $330 per year income over an average life of thirteen years. This would amount to well over $4,000 during the life of the truck. When it is considered that this energy is consumed during the off-peak period at night, it appears that a central-station company can afford to spend a goodly amount of money in helping sell the initial one or two trucks of a customer's fleet. After that the truck salesman and the customer will need little help from the power company except in arranging for added capacity as the fleet increases, if the truck salesman and the utility have been careful in the first sale that only the proper truck was placed in proper electric truck application.

The electric transportation committee of the Great Lakes Division of the N. E. L. A., E. A. Armstrong, chairman, has reached certain conclusions:

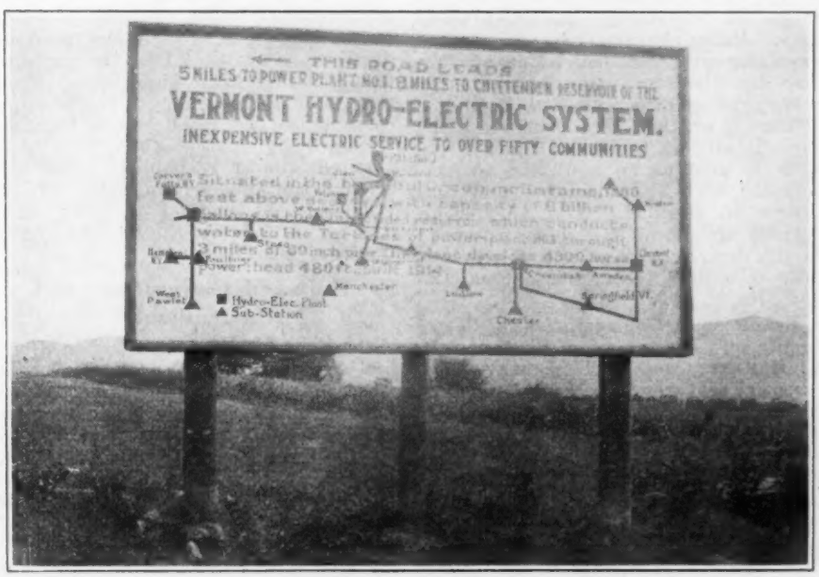
The best central-station charging income is from fleets on regular rates. The first one or two trucks are the hardest to sell. Where the initial installation rate is higher than 3 cents per kilowatt-hour, any reduction is helpful for the development of larger fleets. Such a rate is usually justified, because the load occurs at off-peak periods. More money can profitably be spent in development of the truck load, for fleets grow easily after the initial installation. Furthermore, there is a large untouched field in internal industrial transportation.

Citing a resolution of the national committee, the Great Lakes committee points out that uniformity in electric truck charging rates, as far as local conditions will permit, would exert a beneficial influence toward the development of electric trucks among American industries. If a rate of not more than 3 cents per kilowatt-hour for alternating current were possible under existing local conditions for this service, the influence of the rate on the sale of electric trucks would be substantially eliminated and such a rate, if practicable, would assist the expansion of the industry and increase the electric truck charging load.

As the first sale of any type of proper equipment to a customer is the hardest, and if the central station is to develop the night valley load by the use of electric transportation, the rate for the first truck should be made a little nearer, if possible, the rate earned by a fleet, suggested the committee. Any reduction that could be made would be an assistance in demonstrating the saving possible by the use of electric vehicles and make the sale of larger fleets easier. The first one or two trucks of a fleet might operate on a special limited-hour charging rate. Under this the customer would soon begin to realize the advantages of electric transportation and would add to his fleet. His consumption would shortly place him in position to ask for the regular power rate for small loads and later as the fleet grows and the consumption increases he would be in a position to take advantage of the regular large power rates.

Roadside Billboard Advertises Water Power

EFFECTIVE advertising of its waterpower resources and service is achieved by the Vermont Hydro-Electric Corporation by a highway billboard near the company's Glen station at Rutland. In addition to the system map customarily shown, the board features the conservation of water secured through its Chittenden reservoir and connected pipe line and generating plant facilities.



BILLBOARD FEATURES HYDRO-ELECTRIC SYSTEM

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Comparison of Actual Performance and Theoretical Possibilities of the Lakeside Station.—M. K. DREWRY.—Operating and test figures of the station have been assembled, and a comparison of theory and practice has been recorded. Each of the elements has been investigated separately to ascertain the losses chargeable to it. In boiler operation continuous measurement of the most significant measurable losses allows boiler efficiencies to be deduced quite accurately by totalizing these comparatively small quantities. From some of the detailed tables accompanying the paper the following figures are abstracted:

	Per Cent
Most Economical Loading:	
Boiler efficiency (computed from losses)	91.60
Turbo-generator efficiency ratio (from tests)	76.20
Consumption of auxiliaries	6.09
Coal drying	0.25
Radiation and miscellaneous losses	2.20
Efficiency ratio	64.00
Losses Attendant with Actual Operation:	
Boiler room	2.23
Turbine room	2.01
Unusual operations	0.22
Total operating losses	4.49
Calculated efficiency ratio, average operating conditions	61.1
Theoretical cycle efficiency (Marks and Davis tables)	35.4
Calculated plant thermal efficiency	21.6
Corresponding calculated heat consumption, B.t.u. per kw.-hr.	15,800

—*Mechanical Engineering*, October, 1925.

Transmission, Substations and Distribution

Rectifiers.—X and XI.—These installments of the serial deal at length with thermionic rectifiers, including a recently developed unit for delivering 150 kw. at 30,000 volts from a six-phase supply, another for cable testing at 75,000 volts, at which pressure it can deliver 100 milli-amperes, and various forms of low-voltage gas-filled rectifiers. Data, characteristic curves and diagrams are included. Methods are also described for using rectifiers for transforming direct current from one voltage to another. The principle is the same in all: On the input side the rectifier is used as an oscillator, in conjunction with an inductance and condenser in parallel. The alternating current thus produced is transformed to the desired voltage and then rectified.—*Engineer* (*England*), Sept. 25 and Oct. 2, 1925.

Fundamental Considerations of Power Limits of Transmission Systems.—R. E. DOHERTY and H. H. DEWEY.—The essential features to be considered in a study of power limits are indicated. It is pointed out that the problem of stability may be present in any system where the impedance of the transmitting circuit is high compared with the load to be carried, and that the characteristics of the synchronous apparatus, with the method of voltage regulation used, are of equal importance with the line impedance. The synchronizing power is largely dependent on the field excitation at the time excess load is applied; the excitation is determined by circuit conditions under steady load, and in order to provide for increase of excitation with increase of loads of considerable magnitude, some automatic means of controlling the field is essential. In this connection the use of a mercury-arc rectifier in the alternator field circuit seems to have great possibilities, judging from the results of preliminary experiments. In the paper charts are presented, showing that there is an optimum number of parallel lines (of given constants) for carrying load at a definite voltage over a given distance. An increase of lines above this number will actually decrease the maximum load that can be transmitted. Comments on the paper, made at the Pacific Coast convention of the A. I. E. E., are summarized in the ELECTRICAL WORLD report of the convention, October 10, 1925, on page 691.—*Journal A. I. E. E.*, October, 1925.

Regulation of Earth Potentials of Alternating-Current Systems.—T. R. WARREN.—The paper deals with the change in the value of the earth potential of any part of an alternating-current system when that part is earthed through an impedance of known value. The first portion is devoted to the derivation of a simple equivalent network which represents the various leakage paths of the system, the method of solution being based on Kirchhoff's law. The completeness of the theory in regard to its application under normal conditions of working is then demonstrated, and the effects due both to harmonics in the emf. wave and to the voltage drop along the mains are considered. Methods are described for determining the insulation resistance and capacity of a ground connection—for example, a fault—without interrupting the supply to consumers. The capacity is found by paralleling it with a measured inductance so adjusted that the combination has maximum impedance. From this and the frequency its value can be computed. The resistance is then determined by finding the effect of a shunted known resistance. The last section contains a discussion of the Petersen coil method of earthing.—*Journal of the I. E. E.* (*England*), October, 1925.

Units, Measurements and Instruments

A Distant Indicating Torsion Meter and Some Problems of Shaft Oscillations.—E. B. MOULLIN.—The device here described is designed to measure the torsion of very large shafts, such as the propeller shafts of ships, as well as smaller ones. The relative movement of two sleeves, so fixed on the shaft as to include a length of several feet, causes a variation in the air gap between two parts of an iron core. The latter carries a coil in which an alternating current is made to flow. Change in the gap changes the inductance, and therefore the current in the coil, so long as the voltage and frequency are constant. The ammeter with which the current is measured obviously does not have to be close to the coil; the movement of the ammeter pointer is much greater than the change in length of the air gap. The device is therefore remote-reading and highly magnifying, two desiderata in such an instrument. It can be so designed that over a considerable range the inductance varies linearly with the gap length. To make it independent of the supply voltage the alternating current is taken from a small, permanent-field alternator, motor-driven. Speed changes of the latter change the alternator voltage and frequency simultaneously. If the alternating-current circuit resistance is small compared with the reactance, the current is not affected by the change. For recording the instantaneous fluctuations in torque an oscillograph is used. Records thus taken accompany the article, which, moreover, goes into details regarding the construction and operation of the device and conclusions to be drawn from its indications.—*World Power*, October, 1925.

The Instant Heavisidion.—VLADIMIR KARAPETOFF.—The mathematical solution of transmission-line problems, in the case of long lines, involves tedious computations. Several years ago the same author described a rather complicated device whereby such computations could be performed mechanically. A simplified form has now been developed, readily constructed with very limited shop facilities. It consists of an assemblage of celluloid linkages and scales and enables the user to read directly the current, voltage and power factor at one end of a line when the corresponding quantities at the other end of the line have been properly set by means of appropriate scales. Thus the performance can be determined for any desired set of conditions. With a given construction the new instrument will solve problems for only a definite set of line constants; it is, however, readily reconstructed for other values. The article contains a description of the instrument, its theory, construction and use, with illustrations.—*General Electric Review*, November, 1925.

Motors and Control

Blooming-Mill Drive.—ROGERS A. FISKE.—The largest single-unit reversing motor built to date is said to be the drive of a new 40-in. blooming mill at the Wisconsin Steel Works, South Chicago. The mill is electrified throughout and will supplant a steam-driven mill that has been in service twenty years. Three-phase, 60-cycle current at 2,300 volts is supplied to a 4,000-hp. induction motor driving two 3,000-kw., 700-volt, direct-current generators. A 100,000-lb. flywheel on the motor-generator shaft serves to smooth out the load peaks. The generators are connected in parallel and feed the 7,000-hp., 700-volt, 50 to 120-r.p.m. mill motor. Reversal is accomplished by field control of the generator and motor exciters. The article, which is illustrated, gives other details regarding the mill.—*Iron Age*, Oct. 15, 1925.

Reversed-Rotation Short-Circuit Temperature Rise of Induction Motors.—J. H. R. NIXON.—A method is proposed for determining the temperature rise of large induction motors when means of loading are not available. With reduced voltage at the rated frequency applied to the primary, assumed to be the stator, the rotor is driven at normal full-load speed in opposition to the rotating magnetic field. The rotor windings are short-circuited and the primary voltage so adjusted that full-load current flows in the primary windings. Under these conditions the author analyzes the change in losses as compared with normal full-load operation. Windage and friction are substantially normal; stator copper loss is normal; stator iron loss, because of the low excitation, is negligible, while the rotor losses, particularly the iron losses, greatly exceed the normal, whereby the rotor temperature is made to rise more than in normal operation and the stator receives additional heat from the circulating air. Estimates are made of the magnitude of these various effects, and formulas are derived for applying corrections to the observed temperature rise in order to obtain the probable rise during normal operation. It should be stated that the corrections appear to be quite large, the rotor temperatures being cut down by 40 or 50 per cent and the stator temperatures generally, though not in all cases, raised by a smaller amount, judging from the examples given, although the final results agree well with the figures obtained by direct test.—*Journal of I. E. E.*, October, 1925.

Electrophysics, Electrochemistry and Batteries

Silit.—A resistance material of a high specific resistance, capable of withstanding high temperatures and durable, is made by mixing free silicon and silicon carbide with a volatile carbonaceous binder. This is heated until the silicon is just softened. Extremely dense and firm bodies are thus made. The tendency to a gradual change in resistance has been overcome by exposing the forms of mixed silicon, silicon carbide and carbon to the action of carbon monoxide at a temperature of about 1,500 deg. C. Three classes of material are produced—(1) suitable for permanent leads at glowing temperatures and high momentary loads; (2) for heating resistances for temperatures ranging up to about 1,400 deg. C.; (3) for fireproof material capable of withstanding violent changes of temperature. The specific resistance can be varied almost without limit from 100 ohms upward; the temperature coefficient is negative except for a small group ranging specific resistance from 5,000 ohms to 10,000 ohms, which have a positive coefficient up to 900 deg. C. Some physical properties of the second class of silit (Silit II) are: Breaking stress, 100-200 kg./cm.^{2}; specific weight, 2.95; specific heat, 0.17; coefficient of lineal expansion, about 0.1 per cent at 400 deg. C. and 0.66 at 1,200 deg. C. The article under review gives a number of curves for the properties under various conditions.—*Electrican (England)*, Oct. 2, 1925.

Telegraphy, Telephony, Radio and Signals

Development of New Type of Hornless Loud Speaker.—CHESTER W. RICE and EDWARD W. KELLOGG.—A summary of this paper was given in the ELECTRICAL WORLD report of the spring convention of the A. I. E. E., April 4, 1925, on page 863. First, the results are given of tests on various types of loud speaker, including such devices as the goldleaf thermophone, electrostatic reproducers, siren, agate cylinder machine, talking arc, multiple-unit magnetic telephones, combinations of several horn instruments having overlapping characteristics, and the Hewlett induction telephone. Since one of the worst sources of distortion in the ordinary loud speaker is horn resonance, efforts were made to eliminate this element altogether. For the diaphragm the most satisfactory form was found to be a 45-deg. cone of paper 0.007 in. to 0.010 in. thick, about 6 in. in diameter, flexibly supported around the outer edge by a 0.005-in. rubber membrane ¼ in. wide, under very slight tension. Because of the flexibility of the support the control is by inertia rather than by elasticity. At the lower frequencies the diaphragm moves as a whole, acting as a plunger, with correspondingly good sensitivity for the lower tones; at the higher frequencies there is a gradual transition to wave action or progressive deflection. The drive is by a coil on the cone near its apex, which is open; the coil carries the voice current and moves in the annular opening of an electromagnet. The need of an adequate amplifier to be used with this loud speaker, in order to avoid tube distortion, is emphasized. The discussion of the paper follows later in the same issue.—*Journal A. I. E. E.*, September, 1925.

Radio Interference and the Power Company.—L. J. CORBETT.—The author outlines typical causes of radio interference in the various fields of utilization of electricity, with the aim of indicating the relative part chargeable to power companies. The radio industry itself, movable or extraneous sources, signal lines and equipment, power lines, connected power company equipment, connected commercial loads, household circuits and appliances, are discussed and methods of location described, with measures of mitigation which have been found effective. The discussion incident upon the presentation of the paper at the Pacific Coast convention of the A. I. E. E. may be found in the ELECTRICAL WORLD for October 10, 1925, on page 692.—*Journal of A. I. E. E.*, October, 1925.

Traction

Diesel-Electric Locomotive.—The locomotive described in this article develops 1,000 hp., has a rated maximum tractive effort of 52,200 lb. and weighs 275,000 lb., of which 180,000 lb. is carried on drivers. The engine is of the two-cycle solid injection type, with twelve cylinders arranged in two groups of three pairs each, the pistons in the two cylinders of each pair driving on separate parallel crank shafts. Gears on the two crank shafts mesh with a herringbone pinion on the end of the generator shaft, stepping up the shaft speed of 450 r.p.m. to 1,200 r.p.m. at the generator. The latter is a 750-kw., 750-volt separately excited direct-current machine. The control equipment is of the electro-pneumatic type arranged for double-end operation. With engine running, the locomotive is accelerated from standstill by generator field control. After full voltage is attained, further acceleration is obtained, if desired, by speeding up the engine and thus increasing the voltage. Operation of a 1,000-ton train over a distance of 40 miles, about three-quarters of which was upgrade at about 0.7 per cent, required an average of 3.3 gal. of fuel oil per 1,000 gross ton-miles, at 16 m.p.h. The reverse run, with 2,000-ton trains, averaged 1 gal. per 1,000 ton-miles.—*Railway Age*, Oct. 10, 1925.

Miscellaneous

Oil Purification with Fuller's Earth.—W. D. HEYDEN and D. TYPKE.—Any kind of oil changes its constituency and properties during the service which it has to perform. Whether it is a lubricant, an insulating switch oil or a heat-conducting transformer oil, mechanical and chemical effects will change it gradually to such an extent that it will have to be replaced. This represents an economic loss amounting in our technically advanced age to a very large figure. A simple but as yet not widely enough used method to reclaim old oil is treatment with fuller's earth. The process is inexpensive and so excellent that certain oils can be reclaimed fully to their original characteristics. However, the process is promising and economical only for oils of low acidity. If an oil has been allowed to dissociate to such an extent that its acid component becomes very pronounced, no amount of fuller's earth will reclaim it fully. Tests on a large scale have shown that the process loses in value for more than six-tenths acidity. The hope is expressed of finding a new treating process for fuller's earth which will render it more absorbent and less acid, so as to make possible and profitable a reclamation of even distinctly acid oils. — *Elektrotechnische Zeitschrift*, Oct. 1, 1925.

Rural Electrification.—A group of papers dealing with this general subject in several different aspects and written by different authors are assembled in one issue. One of them takes up design of the line, choice of pressures, transformers and switchgear. The ratio of costs for underground cables and overhead lines is given as 100 to 55. The next paper describes equipment especially adapted to meet farm conditions, such as electrically operated pumps, incubators and plows. The third concerns itself with the application of electricity to village industries. Particular attention is given to the possibilities which the application of electric power offers in wool working, thereby furnishing employment to villagers and thus stemming the tide of the rural exodus. The articles are descriptive rather than statistical and are illustrated. — *Electrician (England)*, Sept. 25, 1925.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

"Electret," The

An electrical analogue of the permanent magnet has been developed and named the "electret." It is a plate of mixed waxes and resin which, after having been melted, has slowly solidified while permeated by an intense electric field exerted between the pan in which it lies and a metal plate reposing on its surface. After this process is finished, the waxen plate has an electrical polarization in the sense to be expected, which soon dies away and is supplanted by a strong permanent polarization in the opposite sense. For details see *Philosophical Magazine*, 1925, Vol. 49, page 179.—*M. Eguchi, Naval College, Tokyo, Japan.*

Engraver, Electric, Pantograph Type

The electrical engraving tool has largely replaced etching, tamping and other older methods of marking parts in machine shops, name plates, scales, rules, etc. An electrical hand-engraving tool takes only 250 watts to 400 watts and enables hardened or unhardened steel and every other metal to be engraved. This tool, however, requires a skilled operator with a steady hand. In order to get over this difficulty, the engraving tool has been combined with a pantograph. Using this apparatus and working from suitable forms, lettering or marking of every kind can be accurately reproduced by unskilled labor.—*Allgemeine Elektricitäts-Gesellschaft, Berlin, Germany.*

Friction, Internal

Internal friction in solids apparently is independent of strain velocity. When an overhanging shaft with a weight on its end is revolved, a slight transverse deflection is produced due to internal frictional hysteresis. By the use of this method it is shown that internal friction in solids is not dependent, as is usually assumed, upon the rate of change of deformation, like fluid friction, but that it acts like ordinary sliding friction. The internal frictional force is found to have substantially a constant value in nickel steel, carbon steel, copper, brass and celluloid, for strain cycles of frequency ranging from one to thirty per second. It does depend upon the amplitude of the strain cycle, however, and is nearly proportional to it. It is found to reverse completely when the deformations are reversed in direction.—*A. S. Kimball, Jr., General Electric Company, Schenectady, N. Y.*

Furnace, Induction

Perhaps the biggest advance in electric furnace matters has been the recent demonstration of the commercial feasibility of melting metals in an ordinary clay graphite or similar crucible, surrounded by an edge-wound copper coil, supplied with power at approximately 500 cycles. This type of high-frequency furnace offers many possibilities, not only in the melting of non-ferrous metals and alloys, but also in the manufacture of relatively small quantities of high-grade steel, say in 500-lb. heats. While this is strictly an induction furnace, no electrodes being used, it does away with the necessity of holding the furnace up to temperature by holding back part of the charge between heats.—*J. A. Seede, Schenectady, N. Y.*

Illumination, Distribution Curves of

The increasing use of asymmetric lighting units has made it desirable to develop more thorough and flexible methods of plotting the photometric data, which have become greatly complicated because the distribution is often different in each vertical plane. A web on which to plot the data has been developed with the requirements of the illuminating engineer in mind, and on this web the photometric data are given by "isocandles" or lines of equal intensities of radiation. By a simple computation the average illumination may be derived without going through the long process of computing the data for the isolux curves.—*Frank Benford, Schenectady, N. Y.*

Transformers, Short-Circuit Tests on

Severe short-circuit tests have been performed on a 1,200-kva. Ferranti transformer to determine their electrical and mechanical effects. For a report on the results see *World Power*, 1925, Vol. 3, page 350.

Water Tester, Recording

The liquid to be tested is caused to flow continuously through a tube containing electrodes between which current is passed. The current for the measurement is provided by a small direct-current generator, forming part of the equipment. The movement consists of two coils mechanically connected together and mounted on a common axis so as to be free to rotate in the field of a permanent magnet. A recording instrument records electrically on a chart the conductivity of the liquid and thus provides a continuous graphic record of the degree of purity of the water or the strength of the solution passing through the tube. The recorder requires unidirectional current, but electrolytic effects prevent the employment of unidirectional current through the liquid resistances. A commutator is therefore placed in each of the circuits between the coils of the instrument and the columns of liquid in series with them. Hence, while the currents in the instrument are unidirectional, they are alternating in the liquid. For details see *World Power*, September, 1925, page 165.—*C. E. Perry, London, England.*

In Progress or Purposed

Alloys, Conductivity of

Work is in progress on the connection between the thermal and electrical conductivities of alloys, with the object of discovering whether accurate determinations of the thermal conductivity of alloys can be arrived at from the determination of the electrical conductivity.—*National Physical Laboratory, London, England.*

Concrete, Permanence and Deterioration of

For the year just past attention has been confined almost entirely to questions of the permanence of concrete when exposed to the severe conditions common to hydro-electric power-plant structures. Concrete is without question the most convenient and economical structural material for this class of construction, but in common with all materials it is subject to deterioration, more or less rapid, depending on its quality and the exposure to which it is subjected.—*Hydro-Electric Power Commission, Toronto, Canada.*

Induction Motor, Single-Phase

It has been shown (*A. I. E. E. Journal*, 1921, Vol. 40, page 640) that the cross-field theory and the revolving-field theory give the same results and that the expression for the total impedance of the motor leads to an equivalent diagram with only one variable branch. These results have been derived mathematically, and it is desired to develop a new physical theory of the machine to correspond to the latter diagram.

Inductive Co-ordination

Tests have been recently completed in Cincinnati on co-efficients of induction and transposition efficiency, shielding and unbalance. This is a part of a larger project which includes studies of co-efficients of induction, configuration, shielding, efficiency of co-ordinated transpositions, telephone circuit unbalances, cumulative effects of successive exposures, attenuation and propagation along the telephone circuit.—*W. V. Lovell, National Electric Light Association, New York.*

Measurements, New Developments in

The laboratory is at present engaged upon the development of a number of new methods of measurement which should prove of considerable value in electrical work. One of these is a method of measuring and permanently recording the speeds of machines under test, with particular reference to large generators and turbines during deceleration and in investigations of governor performance. Another is a system of totalizing a number of individual blocks of power measured at separated points, and obtaining a record upon one centrally located metering instrument. A simple timing device has been constructed for puncturing by means of an electric spark the paper chart of a graphic meter at predetermined intervals, so that accurate time determination is available on high speed records, such as those obtained in measurement of water flow by the salt-water-velocity method.—*Hydro-Electric Power Commission of Ontario, Toronto, Canada.*

Motors, Alternating-Current Commutator Brushes for

The future of alternating-current commutator motors depends essentially upon the progress which can be made in the manufacture of carbon brushes with high current-carrying capacity.—*M. Schenkel, Siemens-Schuckertwerke, Berlin, Germany.*

Quartz Resonators

A number of quartz resonators have been prepared as secondary standards of frequency. It has been found that a piece of quartz can furnish a hundred or so upper partial frequencies. The whole behavior of such resonators is being carefully investigated, and it is hoped to continue the examination down to quartz plates of a thinness suitable for giving fundamental frequencies of 5 to 6 kilocycles per second, since it is highly desirable to develop this type of standard for these ranges of frequency.—*National Physical Laboratory, London, England.*

Relay, Syntonic

An electromagnet provided with two parallel oppositely wound windings, of which the one contains resistance and the other both self-induction and capacity, will not be excited when the current through it has a frequency corresponding to the resonance condition of the latter winding. This device can be applied to relays, so that they will respond to the action of an extraneous current of determinate frequency. The principle may be useful in telegraphy, in the control of distant switches and in electromagnetic railway signals. For a beginning in this direction see *Elettrotecnica*, Vol. 11, page 1023, 1924.

Suggestions for Research

Corona Voltage Under Oil

L. Dreyfuss has shown experimentally that in the air the highly ionized layer adjacent to a high-tension electrode extends to the points at which the voltage gradient is equal to the real breakdown strength of air. In other words, knowing the theoretical distribution of lines of force in the field, the thickness of the corona layer at a given voltage may be computed (*Bulletin Schweizerischer Elektrotechnischer Verein*, 1923, Vol. 14, page 670). It would be of great practical and theoretical interest to extend this investigation to corona formation under oil, in order to give the designer definite data for predicting the corona point.

Interlocks Between Circuit Breakers and Disconnecting Switches

For a safe operation of a power plant or substation it is of importance to assure by automatic means that no disconnecting switch can be opened until the corresponding oil switch has been opened. Some of the interlocks in use are described in the N. E. L. A. Technical Report No. 25-34, pages 9 and 10, and a further study of the subject is desired.

Turbo-Alternators, Use of Hydrogen as Cooling Medium

Tests of a hydrogen-filled machine show that with the same temperature rise 30 per cent greater load could be carried and the efficiency would be more than 1 per cent higher. The reduction of noise was very noticeable. The whole subject is worthy of further careful study.—*H. B. Woodrow, Brooklyn Edison Company.*

News of the Industry

Muscle Shoals Reports In

President Refers Majority Document to Secretaries of War, Commerce and Agriculture

THE President now has before him the reports of the Muscle Shoals Commission. While no part of the reports has been made public, it is understood that the majority view follows the general line of the plan proposed in the Underwood bill, which failed in the last Congress. This view is sponsored by Chairman McKenzie and Commissioners Dial and Bower. The minority report, signed by Commissioners Curtis and McClellan, is thought to advocate complete separation of fertilizer and power activities. They oppose subsidy in any form or to any extent for fertilizer manufacture and are opposed to the government's entering the fertilizer business.

On receiving the majority report the President referred it to the Secretaries of War, Commerce and Agriculture, since the majority members had not complied with his desire that they confer with those Cabinet officers in the formulation of their conclusions.

Statements given the press at the time of the submission of the majority report indicate an effort to discredit the minority members of the commission. It was made to appear that Messrs. Curtis and McClellan are champions of the fertilizer and power industries respectively. It is known that Dr. Curtis favors any sound method of encouraging fertilizer production that does not violate good business practice or ignore economic law. There also is ample evidence that Mr. McClellan has sought only to have the power used for fertilizer, electrochemical activities or public utility use in the proportions best suited to the general welfare. While each of the minority members has opposed hidden subsidies for fertilizer, it is certain they have favored its manufacture on any sound economic basis.

The President is expected to refer briefly to Muscle Shoals in his message at the opening of Congress. Later he is expected to communicate with Congress at greater length on the subject. In the meantime, however, he expects to make public the text of the reports.

M. S. Sloan Deplores Speculation in Utility Stocks

Adding his voice to those of other prominent leaders in the light and power industry, M. S. Sloan, president of the Brooklyn Edison Company and chairman of the Public Relations Section of the National Electric Light Association, said to an interviewer a few days ago that he was opposed to trading in public utility stocks on a speculative as distinct from an investment basis.

"Ours is of its nature a non-speculative industry," said Mr. Sloan. "I greatly deplore the wild buying and price boosting that has been going on in utility stocks. We could not pay fabulous dividends even if we could earn them, which we cannot. We do not cut melons. Public utility securities, in my judgment, are among the best and safest investments, but when people gamble in utility stocks some of them are bound to be hurt. That, you may say, is their own business, but it becomes our business as well if this gambling hurts public confidence in utilities.

"The electric utility company is a public servant. The men who direct public utilities know their obligations and are proud of the responsibilities that rest upon their companies. Our industry is strong; it is sound; it is young and vigorous. Its future is in its own hands, and so long as electric utilities deserve and keep the good will of the public they serve that future is without visible limit."

Interstate Commerce in Electrical Energy

Federal Power Commission Takes Up the Question in Its Annual Report, Dwelling on the Two Classes of Transmission Across Boundaries—Uniform Accounting

IN THE five years ended June 30, 1925, during which the federal water-power act has been in effect there were filed with the Federal Power Commission 524 applications for power developments and 100 applications for transmission lines. Eliminating duplications, the applications for power projects will involve, when built, an aggregate estimated installation of 24,000,000 hp. While a considerable number of applications are undoubtedly for projects that will not be developed for many years, and some perhaps never, yet the aggregate of projects that are reasonably certain of construction in the near future involves more than twice the water horsepower in operation when the water power act was passed in 1920.

During the fiscal year 1925 applications for eighty power projects were filed, involving an estimated installation, if built, of 620,000 hp., and thirty-two applications for transmission lines. Eighteen permits and fifty-three licenses, with an estimated installation of 1,766,000 hp., were issued. At the end of the year there were outstanding seventy permits and 180 licenses aggregating 8,745,000 hp. Eighty-three projects with a prospective installation of 2,646,000 hp. had been completed or were under construction, ten of which, with a combined installation of 197,500 hp., had been started during the year.

Beginning with the above figures, the fifth annual report of the Federal Power Commission, just released, reiterates its recommendations of former years that the water-power act be amended so as to put the commission's operations on a business basis and permit it to carry its personnel on its own rolls, subject to its own control, and that it be authorized to undertake a comprehensive study of the water resources of the streams of the United States, this survey to be financed by the license charges now collected.

Recording a constantly increasing degree of co-operation between the state and federal commissions, the report refers to the desirability of uniform accounting systems, taking on this subject the same ground that was maintained by Executive Secretary O. C. Merrill in the address made by him before the recent Washington convention of the National Association of Railroad and Utilities Commissioners, as reported by the ELECTRICAL WORLD for October 17, page 812.

INTERSTATE COMMERCE IN ENERGY

In dealing with interstate power transmission also the report follows the lines of Mr. Merrill's convention address, in which, it will be remembered, he divided such transmission into two classes—the first where energy is furnished directly to consumers in one state by a company producing it in another, the second where it is transmitted and sold in bulk to another company for distribution. Regulation of the first class of business by the state in which the power is sold, the report holds, does not violate the commerce clauses of the United States Constitution. As to the second class the report says in part:

"It has been suggested that in cases of wholesale purchase where the [state] commission has no jurisdiction over the wholesaling company, it may ignore the purchase price and fix rates to consumers on what it thinks the price ought to be rather than on what it is. Apart from the fact that the question of whether the distributing company shall or shall not purchase at the price offered is an exercise of a managerial function which the courts are loath to permit commissions to exercise on behalf of the utilities, such an act would not be regulation of the character which both public and utilities are justified in expecting to-day. . . .

"It has also been proposed that such a situation could be handled by the states through the medium of interstate compacts which, if approved by Congress, would have the effect of transferring the federal jurisdiction to the states themselves. If there were only occasional cases of such interstate

transfers, or if no transfer affected more than two states, this method might be possible. But the number of cases is constantly increasing, and eventually the transfers will affect groups of states. How readily any such group may be expected to agree upon a common course of action may be judged by the difficulties encountered in the attempt to negotiate the Colorado River compact, where seven states were involved, and the Delaware River compact, where only three were involved."

Federal regulation and price determination in the second class of interstate business is indicated in the commission's report as the proper remedy, but it is not specifically recommended that such authority be vested in the Federal Power Commission. The report goes on:

"The increasing complexity of the administrative problems which the utilities must face as they extend the territory which they serve is not unlikely eventually to bring about a separation of distribution from generation and transmission. Such a situation would simplify the problem of regulation, for distributing companies could then be required to incorporate in the state in which they render service and thus be wholly subject to the regulatory authority of the state. Whether or not this separation does in fact take place, the instances in which regulation by the federal government will be required will be few in number and simple in character, since they will have to do only with wholesale transactions in interstate commerce. Even in these instances federal regulation should be limited to those cases in which formal complaint is filed and in which the state either alone or in co-operation cannot effectively control the situation. Any attempt to extend federal regulation to control over rates and services to consumers would be both unnecessary and unwise. Such a conclusion, however, does not support proposals for leaving a twilight zone of uncontrolled operations, or for ignoring sound regulatory principles, or for the creation of artificial agencies far more cumbersome and ineffective than anything they are created to supplant."

Jobbers Discuss Future of Wholesaling

Readjustment of Methods to Make Adequate Provision for Servicing Sales of Domestic Appliances Held to Be Demanded by Changing Conditions

NEED of readjustment in the business of the electrical supply jobber to meet the changing conditions of the market was the outstanding note of the annual winter meeting of the Electrical Supply Jobbers' Association, held from Monday to Friday of this week at the Hotel Statler, Buffalo. As crystallized in discussion by W. E. Robertson, vice-president Robertson-Cataract Electric Company, the rapid trend toward centralized buying by the electric power industry, owing to the increase in holding-company operation, is taking away from the jobber a very large part of his former market in the sale of construction material and equipment used in central-station extensions and maintenance. Therefore, the speaker said, the jobber must look to other expanding markets, and the greatest opportunity in prospect is in the sale of domestic appliances. To develop volume in this field the jobber must change his attitude toward selling and give far more attention to servicing his sales. The day of the old-fashioned jobber is passing, Mr. Robertson maintained, and the jobber's future will depend much on ability to wholesale these specialties with a highly developed service that will help the dealer sell and insure satisfaction to the consumer.

The desire of the leaders of the jobbing industry to direct the thinking of the meeting toward this broader conception of the function of the wholesaler was reflected in the program. R. F. Pack, vice-president Northern States Power Company, Minneapolis, and first vice-president National Electric Light Association, made an address on the jobber's future relation with generating companies, discussing the importance of adequate and convenient stock and helpful sales service in building and holding the business of the central station and the importance of the jobber's opportunity for usefulness in promoting the interest of the local electrical family. J. E. North, president Electrical League of Cleveland and chairman of the League Council, spoke on the value of an electrical league to a community, picturing out of the experience of Cleveland the practical benefits of league aid in promoting harmony among the electrical interests and developing the market.

Howard A. Lewis, manager *Electrical Merchandising*, speaking on the subject of merchandising, stressed the fact that the average jobber and contractor has been talking to the retail market with a wiring-device vocabulary and habits of thought that are not tuned to the sale of household equipment and "style" merchandise. He urged the jobber to reorganize his business to specialize in definite services that specifically appeal to the modern market.

H. P. Davis, vice-president Westinghouse Electric & Manufacturing Company, talked about the future of radio broadcasting and the influence that may be expected from higher-powered stations, and William L. Goodwin, vice-president Society for Electrical Development, reported on the progress of the "red seal" plan to insure adequate wiring and discussed the part which the jobber should play in its local promotion and guidance.

The first presentation of the James H. McGraw award was made on behalf of the committee of award by Earl E. Whitehorne, commercial editor ELECTRICAL WORLD. The medal and purse were awarded to William R. Herstein of Memphis. Certificates of honorable mention were extended to John L. Buchanan, R. H. Scott, S. C. Greusel and W. A. Requa, as described in detail on page 1075.

West Virginia Water Power

State Official Outlines Bill to Promote Its Development Under Governmental License

IN A LONG statement issued at Charleston, W. Va., recently Edwin M. Keatley, Speaker of the West Virginia House of Delegates and member of the West Virginia Water Power Commission, outlined the high importance of hydro-electric development in that state and gave the salient points of a bill that will probably be introduced at a special session of the Legislature which is expected to be called in January. After a general review of electrical progress and a citation from Secretary Hoover on erroneous popular notions of "superpower" and "giant power," Mr. Keatley said:

"Here in our state we have locked up and as yet undeveloped hydro-electric energy of nearly a million horsepower as shown by the report of the commission appointed in 1921. . . . Under the provisions of the present law (acts of 1913 and 1915) there has been no development of our water power and no possibility of such action, owing to the inability of those desiring to engage in the enterprise to secure financial aid under the restrictions now imposed. Before development of our hydro-electric resources can be accomplished there must be a liberalization of our law that will be fair to the developing companies, yield an adequate return to the large volume of capital required and fully and completely protect the interests of the general public.

"Looking to the accomplishment of this purpose, in the legislative session of 1925 a bill was introduced jointly by Senator Hugus and myself which is based upon the framework of the present law. The basic principle underlying this bill is private ownership strongly regulated by the state. To my mind this is sound American doctrine and the proper method of dealing with corporations serving the public. With the theory of public ownership and operation I have no patience, and the many disastrous experiences in the past have, I believe, fully convinced a majority of the people that such action is unwise and inadvisable."

PROVISIONS OF BILL

Mr. Keatley in his statement proceeded to analyze the bill he favors section by section. It is drawn to harmonize with the federal water-power act and provides for fifty-year licenses by the state to hydro-electric companies, work to be started in two years from the time the plans are approved by the Water Power Commission and to be completed in five years. At the end of the fifty-year period the principle of the indeterminate license may be applied. It is provided that in addition to an annual license tax on its charter and to all other taxes and assessments, every licensee shall pay to the state an annual royalty for the privilege of exercising the rights granted under the act, which annual royalty shall be 1 per cent of the gross revenue derived from the sale of all the energy or power produced by such licensee from the water-power project which is the subject of

the license. Such gross revenue shall be calculated at the reasonable wholesale rate for electrical energy, applied at the place of generation thereof, which rate shall be fixed by the commission.

Mr. Keatley in his capacity as Speaker is a member of a special commission of political leaders appointed at the last legislative session to draft water-power legislation, and he will submit his bill to this commission when it meets.

Rural Electrification to Be Pushed in Texas

How the rapidly extending electric transmission lines in Texas may best serve the farmers is receiving serious attention from the power companies there, and at a recent meeting of representatives of electric power companies over which John W. Carpenter of Dallas, vice-president and general manager of the Texas Power & Light Company and chairman of the rural lines committee of the Southwest Geographic Division of the National Electric Light Association, presided, a rural service committee was appointed. This committee is headed by Prof. D. Scoates of the Texas State Agricultural and Mechanical College.

At the first meeting of the committee Professor Scoates said that he was especially interested in the question of using electric power for threshing and told of his surprise last summer at finding electric motors in use by peasant farmers in Europe.

Sterlington (La.) Generating Plant Opens

State and municipal officials and leading citizens of Louisiana, Mississippi and Arkansas participated in the formal opening of the Sterlington steam plant of the Louisiana Power & Light Company this week, when Tuesday and Wednesday were given over to celebration. Sterlington is on the Ouachita River, 16 miles above Monroe, La., and the plant will be interconnected with the lines of the Arkansas Light & Power Company in Arkansas and the Mississippi Power & Light Company in Mississippi, 110,000-volt cables being carried across the Mississippi River to Vicksburg in a 3,500-ft. span suspended from 275-ft. steel towers—one of the longest spans bridging a river anywhere in the country. The initial installation is two Westinghouse units rated at 15,000 kw. each. The station is designed for an eventual capacity of 150,000 kw.

Asks for Revocable Permits in Fifty-nine Communities

The Oklahoma Gas & Electric Company has given notice of relinquishment of electric franchises in fifty-nine Oklahoma cities and towns. In return for these franchises the company requests revocable permits in compliance with provisions of the bill passed by the last Legislature. The cities affected by the application include Oklahoma City, Muskogee, Ada, Harrah, Enid, Drumright, Sapulpa, Shawnee, El Reno and Norman.

Voluntary reduction of electric service rates to certain classes of business, together with downward revision and adjustments to others, has also been announced by the Oklahoma Gas & Electric Company. These reductions have been made possible because of two definite factors. The first and prime factor is the immediate effect of the revocable-permit bill, passed by the last Legislature, making it easier and cheaper for the electric company to finance its bonds, through the sale of which a large amount of the money for development and construction is obtained. The second factor is an indirect effect of the revocable-permit law, in that economies have been effected through ability to obtain bond money for the construction of large, economical generating plants and the extension of transmission lines to serve cities and towns, oil fields and coal fields.

Alabama Power Company's New Office Building

TAKEN a few days ago, the photograph above is one of the first showing the new office building of the Alabama Power Company at Sixth Avenue and Eighteenth Street, Birmingham, now nearly completed, though still awaiting the statue of Alabama which is to adorn the roof. This granite and limestone building covers 9,000 sq.ft. and rises twelve full stories above the ground, terminating in a massive tiled superstructure which makes its height equivalent to that of a building of sixteen stories.

The entrance on Eighteenth Street is marked by two pylons placed one on each side of the door. These pylons are about 40 ft. high, connected across the top with a frieze containing three sculptured figures symbolizing "Light," "Heat" and "Power," the products of the Alabama Power Company. The new Southern office of the ELECTRICAL WORLD is on the fourth floor of this building.

Wyoming for Progress

Utility Association Strong for Better Public Relations Won by Service—Advantages of Merchandising

ADVANTAGES of central-station merchandising and the absolute necessity of efficient selling methods, not only for electrical energy and merchandise, but also where public relations are concerned, were the dominant themes in the fourth annual convention of the Wyoming Utility Association, which met in Cheyenne on Monday and Tuesday last, November 16 and 17. Better public relations and improved service were vigorously advocated by many speakers, some of whom declared that a need existed of organization activity to bring these ideas home to the executives of the various utilities scattered throughout the sparsely settled sections of the state. This attitude was occasioned by the decrease in attendance of utility representatives from the more remote sections of Wyoming, and as a result a special effort is to be made to have as many of them as possible attend both the annual midwinter meeting of the N. E. L. A. Rocky Mountain Division in Denver early in December and the next meeting of the Wyoming association, scheduled for June, 1926.

The convention was auspiciously opened by Governor Nellie T. Ross, whose address of welcome displayed a keen insight into public utility problems and a feeling of confidence on the part of the state administration regarding its relations with the various utilities as maintained through the Public Service Commission. H. B. Henderson, Jr., president Cheyenne Chamber of Commerce, also welcomed the delegates, stressing the value of customer ownership of utility securities as observed in his own experience.

Three fundamental reasons for merchandising by public utilities — especially light and power companies—were given by G. L. Buck, superintendent of electric sales of the Public Service Company of Colorado, with headquarters at Denver. He said that efficient merchandising was demanded in the interest alike of good public relations, gross merchandise sales and revenue increases. Charts illustrating the various points of the talk were shown, including one showing that central-station selling methods at the present time are only 40 per cent efficient. The interest manifested in this subject led to further discussion following the luncheon and business meeting which concluded the convention.

The success of the Rocky Mountain Committee on Public Utility Information was recounted in several of the papers, and the work of the Electrical League of Colorado, including its "red seal" plans, was explained.

C. L. Titus, Wyoming manager of the Mountain States Telephone & Telegraph Company and president of the association, presided at the meetings. For the ensuing year he is to be succeeded by James Potts, manager of the Rawlins Electric Light & Fuel Company. James J. Withrow, manager of the Sheridan County Electric Company, and W. D. Johnston of the Natrona

Power Company, Casper, were elected vice-presidents. H. C. Chappell, Midwest Public Service Company, Casper, was named treasurer. These officers, with R. E. Richardson of Lovell and the retiring president, will constitute the new executive committee. Registration at the convention totaled sixty-five.

Northwest Cities Ask to Sell Power Outside Limits

A bill which would permit municipalities in the State of Washington owning or operating their own light and power plants to sell excess power outside their corporate limits is to be introduced at a special session of the Washington Legislature which convened November 9. Under the bill a city may sell any surplus energy to any other municipal or governmental agency which owns or operates its distribution system and which is situated within 75 miles of the limits of the city owning the generating plant or within 25 miles of its transmission lines. It further provides that sales may be made to any person, firm or corporation within 10 miles of the city generating the power or within 3 miles of its transmission lines. Proponents of the bill claim that these restrictions would prevent cities from going into the wholesale power business provided for in the Bone bill, which was defeated at last year's election.

Unlike other measures which have been proposed, the bill would impose a tax of 5 per cent on all such sales of energy, which tax would be paid into the state treasury. Rates would be fixed by the cities themselves, but would be limited to not more than 15 per cent, inclusive of the state tax, in excess of the rates inside the city having the power to sell. Otuside customers buying power would be protected from being disconnected by the same rules that apply to customers within the city.

Cities would be permitted to make plant and transmission-line extensions necessary to delivery of power, but would be prohibited from acquiring or maintaining a distribution system in any other city or town. According to the backers of the bill, this provision would make it necessary for other municipal corporations buying power to distribute it themselves. The bill is the outcome of conferences between representatives of Seattle and Tacoma and cities in western Washington desirous of obtaining power from the municipal plants of the two larger cities.

Devon Plant to Be Enlarged

The Connecticut Light & Power Company, Waterbury, has decided to install two new boilers of 1,680-hp. rating each at its Devon station, and early in 1926, if load conditions warrant, will purchase a new steam turbo-generator unit. The size of the latter has not yet been determined. Three 25,000-kva. machines are now in service. The Devon station was described in the ELECTRICAL WORLD for March, 1924, page 563, and is one of the most important tidewater generating plants in southern New England. It is interconnected with the company's hydro-electric plants at Stevenson and Bulls Bridge and now carries the major portion of the central-station load of the Naugatuck Valley.

The company owns undeveloped water rights on the Housatonic River and its lines are interconnected with the systems of the Hartford Electric Light Company and the Connecticut Power Company. Recently the Connecticut Light & Power Company acquired control of the Meriden Electric Light Company, and a new substation of 10,000-kva. rating is under construction to facilitate service at Meriden. The Bristol & Plainville Electric Company will probably be acquired in the near future, but at present energy for this system is furnished by the Connecticut Power Company under a long-term contract. The industrial electric heating load of the Naugatuck Valley is growing by leaps and bounds.

For Initiated State Ownership in Oregon

Making good the expressed intentions of certain semi-political groups in Oregon, there have been filed with the Secretary of State two proposed measures looking to the establishment of state-owned power systems. This filing is required under law for the purpose of having the bills titled by the Attorney-General preparatory to the circulation of initiative petitions which, if sufficient signatures are obtained, will entitle these measures to a place on the ballot to be voted on by the people at the next general election in 1926. Both measures involve an amendment to the constitution of the state.

The first, sponsored by the Housewives' Council, Inc., Portland, has been called the Oregon water and power board development measure and seeks to vest the control over the conservation, development, storage and distribution of electrical energy and water for irrigation and domestic purposes in a board of five elective members, the personnel of the first board being named in the amendment. Provision is made for the issuance of state bonds in an amount not exceeding 5 per cent of the state's assessed valuation and for an initial appropriation from the general fund of the state of $250,000 for an administrative fund, later returnable from the revolving fund created under the proposed act.

The title given to the second proposed measure, which was prepared and filed by the Oregon State Grange, is the water, water-power and hydro-electric energy constitutional amendment. This measure would authorize the state to control and develop the hydro-electric energy within the state and to contract with political subdivisions and others for its transmission, distribution and sale; to maintain and operate plants in this connection, authorizing state credit and indebtedness to provide funds for the purposes of the act. As originally filed the measure placed no limit on the amount of bonds which might be issued under it, but a later filing restricts such bond issues to an amount not exceeding 4 per cent of the total assessed valuation of the state. Differing from the first proposed amendment, which attempts to specify the machinery of administration, that proposed by the grange places the administrative detail in the hands of the Legislature.

Baker River Plant Ready

Puget Sound Company's New Hydro-Electric Development Will Soon Be in Full Service

WITH the gates of the huge concrete power dam of the Puget Sound Power & Light Company on the Baker River now closed and the water piling up behind it, the first generation of electricity from Washington's newest hydro-electric plant will take place in the near future, if it has not actually done so before this is printed. The reservoir, which will be named Lake Shannon in honor of W. D. Shannon, engineer in charge, will be more than 7 miles long and will have a surface area of 1,780 acres. The dam, built across Eden Gorge, is 245 ft. high and 180 ft. thick at the base. It contains more than 220,000 cu.yd. of concrete masonry.

The first two 20,000-hp. turbo-generators are now in place. Its ultimate capacity will be 80,000 hp. The main pressure tunnel has been constructed through the solid limestone of the canyon's side and is 24 ft. in diameter. This tunnel is approximately 1,300 ft. long, lined with concrete. A steel penstock connects the pressure tunnel with the power house. The cost of the undertaking, including a 13,000-kw. substation at Sedro Woolley, is exceeding $8,000,000.

A world's record is claimed for the construction of this project. No other plant of equal power, it is said, has been built in so short a time or at a smaller relative outlay, and this despite the fact that last winter proved one of the worst on record. Construction was started April 1, 1924. Baker River power will go through the largest out-of-doors substation in the Pacific Northwest, at Beverly Park, near Everett, and another at Sedro Woolley. Transmission lines will lead to Bellingham from Sedro Woolley and also to Beverly Park and from there to Seattle, crossing the Lake Washington canal on steel towers 233 ft. high.

Contracts Let for Detroit's New City Plant

Contracts totaling almost nine million dollars have been awarded by the Detroit Public Lighting Commission for a new municipal power plant to supply energy for all city requirements, including the operation of the street railways. This plant, as authorized by the voters, must not exceed $12,000,000 in cost, and for that reason the original project for a four-unit 60,000-kw. plant was altered to one for a plant of three units totaling 45,000 kw., with provision for adding a fourth turbo-generator when necessary. The contracts so far let provide for a substructure costing $562,000, a superstructure costing $1,534,800 and the machinery and equipment listed under "Activities of the Trade" on page 1077.

New England Power Needs

Ferguson Says 500,000 Hp. in Reserve Capacity Could Be Put on Lines —M. J. Insull's Faith

CO-ORDINATION of effort for regional development took permanent form last week at the New England Conference initiated by the governors of the Northeastern States, when 625 delegates, representing 288 business and public utility organizations, met at Worcester and discussed vital problems in power supply, agriculture and marketing. On November 12 an entire session was devoted to power, and stirring addresses upon the economic value and trend of interconnection and power pooling were given by O. D. Young, M. J. Insull and Samuel Ferguson, Mr. Ferguson presiding over the session. Mr. Young's address, which urged New Englanders to eliminate state lines in power pooling, was abstracted in last week's ELECTRICAL WORLD, page 1016.

Chairman Ferguson, in his opening address, sketched the rise of interconnection and power pooling and pointed out that 500,000 hp. in unused reserve generating plant capacity exists between Boston and New York, an idle investment of $50,000,000 which could be put to work with the more complete interconnection of power centers. Touching upon rural service, he said that "it would not have been proper to handicap urban central-station development by endeavoring to carry on higher-cost rural service at the same time, nor to undertake this work during a period of increasing costs. Had this been done, electric rate increases would have been greater than otherwise necessary." The speaker held that the city companies should carry the burden of unprofitable rural extensions during the period, and only during the period, of development. Referring to manufacturing developments in the electrical industry, Mr. Ferguson said that one of the greatest triumphs is the production and sale of the wonderfully efficient "Mazda" lamp at a price very little in excess of that of an ordinary lamp chimney.

Martin J. Insull, president Middle West Utilities Company, Chicago, the holding company controlling the recently formed New England Public Service Company, spoke upon "Why the Insull Interests Are Expanding in New England." Mr. Insull said that faith in the future of the Northeast is at the bottom of their program. It is believed that the advantages of centralized management, power pooling, interconnection and co-ordinated development of power resources in Maine, New Hampshire and Vermont will justify the purchase of the companies now being grouped under the Insull banner. Enormous amounts of capital will be required to develop the electric power and light industry, and without the use of holding companies the progress lately attained and demanded would have been and must be impossible.

Dexter P. Cooper, engineer of the proposed tidal power development on Passamaquoddy Bay, Maine, described that project.

Following the meetings, a permanent organization was formed under the name of "the New England Conference," and among representatives elected to membership in the council who are known to the electrical industry were Walter S. Wyman, president of New England Public Service Company, Augusta, Me.; Edwin S. Webster, president Stone & Webster, Inc., Boston; Howard Coonley, president Walworth Manufacturing Company, Boston; David Daly, president Blackstone Valley Gas & Electric Company, Pawtucket, R. I.; A. L. Linn, Jr., Newport (R. I.) Electric Corporation; Henry Trumbull, vice-president Trumbull Electric Manufacturing Company, Plainville, Conn.; E. O. Goss, president Scovill Manufacturing Company, Waterbury, Conn., and H. B. Knight, vice-president Southern New England Telephone Company, New Haven.

Southwestern N. E. L. A. Men Hold One-Day Meeting

At a one-day convention of the Southwestern Geographic Division of the National Electric Light Association held in Dallas on November 13 relations between employer and employee in the industry, as well as matters relating to group insurance, pensions, annuities and other related subjects, were discussed. Representatives of light and power interests from Texas, Louisiana, Arkansas, Oklahoma and Florida attended the session, which was presided over by Chairman C. J. Rutland of the Texas Power & Light Company, Dallas.

A. B. Gates, manager of the industrial relations department of the Commonwealth Edison Company of Chicago, described this work as carried on by the national association and by his own company, laying especial stress upon the mutual responsibility of employer and employee in maintaining good public relations and satisfactory service. L. B. Flowers, president New Orleans Public Service, Inc., spoke on group insurance and pension methods for employees. S. J. Ballinger, San Antonio Public Service Company, also dealt with this topic. Other speakers included George A. Davis of the Oklahoma Gas & Electric Company, H. B. Bennett of the Dallas Power & Light Company and C. J. Griffith of the Arkansas Central Power Company, Little Rock. A luncheon was given by John W. Carpenter, president of the Texas Power & Light Company.

Quebec Tightens Restrictions Against Power Export

Announcement comes from Canada that in view of the large water-power developments expected at points near the Ontario border, the Quebec government has altered its terms of lease contracts for the harnessing of such waterfalls, so as to prevent any of the energy being exported to the United States. Not satisfied with the clause which in the case of the Grande Décharge and the Chute à Caron works prevented the export of power across the border, and not even with the ordinary condition that permits granted could be altered from time to time, an additional clause has been inserted in the lease by which power, even when taken to another province, cannot from that province be exported to the United States without subjecting the lease to cancellation. A few recent leases have been subjected to such terms, and in future, until the policy of the Prime Minister shall have been altered, a protective clause must be signed by those intending to harness waterfalls in the province. It is understood that some of the interests planning developments along the Gatineau and Ottawa Rivers have consented, with reservation, to co-operate with the Quebec government in this sense.

Skagit Needs $9,411,000

This Would Bring Seattle Municipal Plant to Size Soon Required, Says Superintendent

ASSERTING that Seattle will demand an additional 160,000 hp. from its municipal plant in three years—double its present output—or at the least that a large part of this additional energy should be ready before the winter of 1929, Superintendent of Lighting J. D. Ross has recommended to the city government that it concentrate all its efforts on enlarging the Skagit plant by building new dams and generating plants according to the following schedule:

1. Railroad to Diablo Canyon, to be finished early in 1927; cost	$425,000
2. Dam at Diablo and third unit at Gorge, to be finished by September, 1928; cost together	1,850,000
3. Transmission line to South Station, to be completed by September, 1929; cost exclusive of right-of-way and line inside city built previously...	1,986,000
4. First unit of 110,000-hp. station at Diablo, and Ruby Dam to elevation 1475; cost.....	5,150,000

This, Mr. Ross says, will give a capacity of 185,000 hp. at Skagit, all of which would be stabilized by the present steam plant. It means an added capacity of 135,000 hp. for $9,411,000, including a second transmission line on steel towers, which is $69.80 per horsepower.

Further steps in order would be, according to the superintendent's plan:

5. Raising Ruby Dam to elevation of 1,600 ft.
6. Second unit at Diablo, 110,000 hp. added.
7. Power house at Ruby Dam, developed by steps to full capacity, depending on load factor; probably 200,000 hp.
8. Gorge Dam, second tunnel and power house, making 225,000 hp. at the Gorge.

Mr. Ross recommends an immediate thirty-year bond issue for $2,500,000 to install the third unit at Gorge and build the railroad to Diablo Canyon, further bonds to be provided progressively. The first issue, he says, would provide 75,000 hp. at Skagit every day in the year.

In a later report Superintendent Ross submits estimates for extensions and betterments to the city's plant amounting to $4,000,000, to meet which he recommends an issue of bonds to be sold as fast as needed. These estimates include $768,251 for extensions to serve customers, $400,000 for underground distributing circuits, $524,752 for the Spring Street station, $624,400 for the South station, including equipment for the Tacoma line; $240,000 for automatic oil-switch and relay equipment for city substations, and $1,110,197 for loans receivable on account of previous construction.

Briefer News

Vandalia, Ill., Gives Up Its Municipal Plant. — The Illinois Power & Light Corporation has taken over the municipal light plant and distribution system in Vandalia, Ill. It paid $130,000 cash and granted $60,000 in street-lighting concessions for the properties.

Enlargement of Detroit Edison's Trenton Channel Power House.—Preparation for the installation of a fourth 50,000-kw. turbo-generator is being made at the Trenton Channel plant of the Detroit Edison Company. Present plans call for the installation of only one more unit, but the turbine structure and superstructure are being extended to accommodate six machines. The boiler-room foundation also is being enlarged to twice its present size.

Idle Days on Southern Power System Down to One and a Half a Week.—Beginning Monday last, a second increase was made by the Southern Power Company in the number of days a week during which full service would be rendered to its industrial customers, who have been restricted owing to the unprecedented lack of rainfall. Idle days until further notice will be only one and a half a week.

Maryland "Observer" for Tri-State Commission Named.—Governor Ritchie of Maryland has appointed Harold E. West, chairman of the Maryland Public Service Commission, as unofficial observer to attend the meetings of the tri-state power commission of New York, New Jersey and Pennsylvania. "Mr. West will not be a member of the commission in any sense," Governor Ritchie said, "but he will listen to the proceedings and will be able to see that nothing is 'put over' on Maryland."

Tennessee Electric Power Will Start Work on Blue Ridge Plant in 1926.—The Tennessee Electric Power Company will begin construction on the first unit of its proposed three-million-dollar hydro-electric development at Blue Ridge, Ga., in 1926 and will spend $1,500,000 the first year. The reservoir will be formed by damming the Toccoa River 4 miles from Blue Ridge and thus forming a lake covering 2,200 acres. The dam will be 800 ft. long and 160 ft. high. The new plant will develop 22,000 hp.

International Paper Company's Interest in Grand Falls Assailed.—Premier Baxter of New Brunswick has issued a statement with respect to the hydro-electric development of Grand Falls, on the St. John River, in which he declares that the contract between the New Brunswick Electric Power Commission and the International Paper Company, concluded during the régime of ex-Premier Veniot, is a "monstrous injustice" in that it "fetters the action of the Power Commission in every possible direction." Other companies declare that this agreement restricts their development, and Premier Baxter is seeking to induce the International Paper Company to forgo the strict letter of its agreement and enter into an arrangement with the other applicants for power.

Virginia Electric & Power Company Rates Cut.—Substantial reductions in all lighting rates of the Virginia Electric & Power Company to customers using more than 60 kw. a month have been ordered by the Virginia State Corporation Commission, effective January 1. Approximately 70 per cent of all the company's lighting customers will benefit. The new rate will be 9 cents, instead of 10 cents as heretofore, with an optional flat rate to those who use energy for cooking or refrigeration. Reductions in the rates of the company since January 1 last total about $275,000 annually.

Meeting of Empire State Electric Section.—The annual meeting of the Electric Section of the Empire State Gas & Electric Association will be held in the auditorium of the New York Edison Company substation, 54 West Twenty-seventh Street, New York, on December 4 and 5. The tentative program includes, in addition to the reports of the transmission, apparatus, radio, operation, underground and overhead committees, an address on "Our Common Task" by Howard T. Sands, vice-president C. H. Tenney & Company. Inspection trips have been arranged.

Electric Welded Pipe for Water Project.—Eighty-five miles of electrically welded pipe is to be used in connection with the Mokelumne domestic water supply project of the city of Oakland, Cal. The pipe will vary in diameter from 60 in. to 65 in. and in thickness from ⅜ in. to ⅝ in. and will be manufactured in Oakland. The contractor who bid on the electrically welded pipe received the contract on the basis of certain rigid specifications as to workmanship and strength and because of a four-million-dollar saving over any other method of manufacture. Samples of electrically welded pipe submitted to the board of engineers on the job are said to have shown beyond question the practicability of electric welding for a job of this kind, and the tests required will be ample to assure the required efficiency at every joint.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

American Society of Mechanical Engineers—New York City, Nov. 30-Dec. 4. C. W. Rice, 29 West 39th St., New York.

Empire State Gas and Electric Association, Electric Section—54 West 27th St., New York, Dec. 4 and 5. C. H. B. Chapin, Grand Central Terminal, New York.

American Society of Agricultural Engineers, North Atlantic Section—Schenectady, N. Y., Dec. 10-12. Raymond Olney, St. Joseph, Mich.

Western Association of Electrical Inspectors—Hotel Sherman, Chicago, Jan. 26-28. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—New York, Feb. 8-12. F. L. Hutchinson, 33 West 39th St., New York.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Prince Conti Receives Felicitations from American Colleagues.—An incident of international comity which arose from the meeting reported last week of the United Engineering Societies in New York City to discuss subterranean heat as a source of energy was the dispatch to Prince Ginori Conti at Larderello, Italy, of the following message signed by John W. Lieb of the New York Edison Company and Prof. L. P. Breckenridge of Yale: "The New York branches of our national engineering societies, assembled in joint meeting to discuss the utilization of subterranean heat as a source of power, send you their hearty greetings and felicitations as the world's great pioneer in this new field." In a return cablegram Prince Conti expressed deep appreciation of the compliment paid him.

Engineers Discuss Accident Prevention.—Dr. M. I. Pupin, president of the American Institute of Electrical Engineers, presided and John W. Lieb, vice-president New York Edison Company, was a prominent speaker at the evening session of a conference on accident prevention held in New York on Wednesday, November 18. Mr. Lieb's subject was "Standardization and Safety." C. E. Skinner of the Westinghouse company, Dean Kimball of Cornell and S. W. Ashe of the General Electric Company were other speakers. The meeting was held under the joint auspices of the Engineering Section of the National Safety Council and the metropolitan sections of the four major engineering societies.

Another Dispute Over Wisconsin Territory. — Approval by the Wisconsin Railroad Commission of the rates named in a power contract entered into between the city of Clintonville and the Wisconsin Traction, Light, Heat & Power Company of Appleton for the purchase of energy for local distribution purposes has been followed by protests from the Central Wisconsin Power Company of Oshkosh and the Wisconsin Power & Light Company of Madison, both of which claim infringement on their territory. The two contending companies have obtained a temporary injunction against the other, upon the legality of whose contract the commission did not pass.

Chelan River Project Awaits Only Federal Approval. — Confirmation of contracts for the erection of a hydro-electric plant on the Chelan River near Chelan, Wash., was announced in Spokane on November 6, following a formal announcement from the general office of the Great Northern Railway at St. Paul stating that the Washington Water Power Company would go ahead with the development. On the

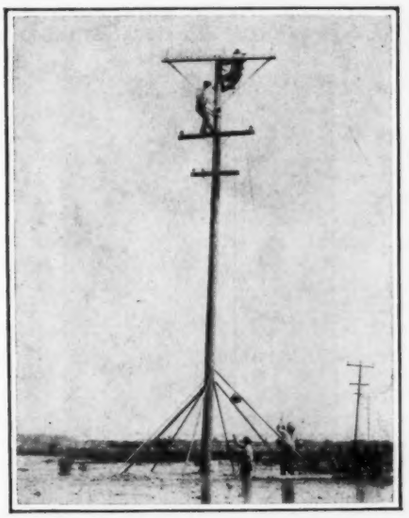
same day the state authorities announced that approval had been given the Chelan Electric Company, a subsidiary of the Great Northern, for the erection of the plant. There remains to be acquired only federal approval before work begins. Reports place the installed capacity of the project at 75,000 hp. and the cost at approximately $10,000,000.

A Dam Failure in Wales.—A breach in the earth work forming the foundation of a dam built in a natural lake in the Welsh hills used as a storage reservoir for the North Wales Power Company, which has two power houses, and the Aluminium Corporation caused the release on November 2 of a vast volume of water, which precipitated itself from a distance of about 4 miles and at a vertical depth of nearly 1,000 ft. upon the village of Dolgarrog, destroying property and causing the death by drowning of about twenty persons. The lake is about a mile long. The water found some arrestment in a subsidiary reservoir which immediately overhangs a cliff above Dolgarrog. This proved ineffective, however, and an almost perpendicular drop of 500 ft. or 600 ft. from the edge of the tableland to the village below, together with the narrowness of the rocky gorge, gave the flood devastating power.

Washington Water-Power Site Contested.—Numerous claims to a large water-power site on the Cowlitz River at Mossyrock in western Washington are to be heard by the Washington State Department of Hydraulics at Olympia on November 23. H. W. Crozier, holding a permit for the Chehalis, Cowlitz & Cascade Railway, has filed an amendment to his original application to increase the height of a proposed dam from 135 ft. to 300 ft., which would give a storage of 1,000,000 acre-feet and develop 120,000 continuous horsepower by the utilization of 4,000 cu.-ft. per second. According to the applicant the project would cost approximately $6,000,000. The hearing will be attended by representatives of the Chicago, Milwaukee & St. Paul Railway, C. C. Garland of Tacoma, J. G. Kelly of Portland, the Cascade Electric Company of Seattle and others interested in rival projects. Large Eastern manufacturing interests are said to be backing some of those seeking water rights on the river.

Tenant Farmers and Rural Electrification in Oklahoma.—Farm electrification and radio were extensively discussed at the Central District conference of the Electric Light and Power Division, Oklahoma Utilities Association, at Oklahoma City on November 12. The preliminary report on progress now being made by the sub-committee of the farm electrification committee revealed the fact that Kansas now has nine hundred farms receiving electrical service from central power stations. A survey of these farms showed that the electrification was not confined to farms owned by those living upon them but that from 6 to 33 per cent of these farms were occupied by tenants. "Fifty-seven and one-half per cent of the farms in Oklahoma are occupied by tenants," declared Prof. Edwin Kurtz, chairman of the committee. "This has led some to fear that farm electrification could not be accomplished in Oklahoma. The survey in Kansas, however, gives us a more optimistic outlook and shows that while tenantry is an obstacle to farm electrification it is not impossible to extend electricity to a certain percentage of such farms." F. B. Hathaway, Oklahoma City, state manager of the General Electric Company, was chosen district chairman, and Doyle Jurney, manager of the Minnesota Electric Light & Power Company at Cushing, district secretary.

Restoring Service Under Difficulties.—The illustration shows the conditions under which linemen of the Pacific Gas & Electric Company had to work in restoring service on a 60-kv. line on Woodward Island in the San Joaquin delta recently. A brush fire got from under control and spread to a nearby stubble field, quickly menacing the whole island. The soil of these delta lands is composed almost entirely of



decayed vegetable matter which is inflammable when dry and when ignited will smolder for days. The only salvation, that of flooding the entire island by cutting levees at strategic points, was resorted to, but ten poles carrying a 60-kv. and an 11-kv. circuit were completely destroyed by the fire before the area could be flooded. Electricity furnishes the motive power not only for irrigation pumps but for drainage pumps as well. These are called into service when floods occur, and it was therefore necessary to re-establish service on the damaged line before the island could be drained. Working waist-deep in water and mud, struggling through masses of floating débris, it took the workmen nearly a week, to restore the missing poles.

New York Water Power Commission Fixes Charges for Canal Water.—The New York State Water Power Commission has fixed the rental charge for the use of surplus waters of the Barge Canal at Rochester by the Rochester Gas & Electric Corporation at $50,000 annually. It also put the rental charge for the use of surplus canal waters at Medina, a joint application for the use of which was made by S. A. Cook & Company and the Western New York Utilities Company, at $10,000 annually. Hearings on these rates will be held. The commission granted a preliminary permit to the Lower Niagara River Power & Water Supply Company, conditioned upon its acceptance by that company within thirty days from date, covering the use of water power in the Niagara Gorge.

New Transmission Circuit for North Iowa.—Poles for a high-voltage transmission line between Quimby and Storm Lake, Iowa, have been set by the Sioux City Gas & Electric Company, and it is planned to have the line in operation by Christmas, according to W. J. Bertke, vice-president. It will be a link in the chain of lines the company is building in northwestern Iowa, which will comprise a circuit of more than eighty towns now being served by the Humbodlt plant, purchased four months ago. The new line, which will cost $335,000, runs north from the new power plant at North Riverside, 6 miles from Sioux City, then turns east through Hinton and continues to Storm Lake. When it is completed it will be connected with the plant at Waterloo, giving a double source of supply.

Electrification of Texas Oil Field.—Electrification of the Luling (Tex.) oil field by the United North & South Oil Company will be partly in effect by November 25, when the first three units of the company's electric power plant are expected to be in operation. Two additional units will be finished early in December, it is stated. The cost of the power plant and transmission lines will be approximately $750,000. The primary purpose of the plant is to furnish power for operating the company's own pumping plants and drilling rigs in the field. The matter of selling power to other oil companies has not as yet been considered, it is asserted. The plant will be rated at 2,200 kw. Although there is a high-tension line within 14 miles of this oil field, the United North & South Oil Company decided that it could produce power cheaper than it could buy it.

Electric Men Killed in Railroad Disaster.—Four General Electric men were killed and two were injured in the train wreck which occurred on the Pennsylvania Railroad near Plainsboro, N. J., on November 12. The dead were R. D. Reed, a member of the General Electric industrial department and in charge of the sale of electric arc-welding equipment; Mark A. Atuesta and Arthur W. Gross, members of the manufacturing department, and John C. Horstman of the manager's staff at the Schenectady plant. The injured were D. H. Deyoe of the industrial engineering department of the company and Thomas Wry of the Lynn River works. All the men had met in Baltimore in connection with the interworks welding committee of the General Electric Company and were en route to the Bloomfield plant when the accident occurred. George Y. Allen, technical assistant to the manager of the Westinghouse Electric & Manufacturing Company's radio department, also lost his life in this disaster.

Men of the Industry

R. L. Lindsey New President of Southeastern Division

R. L. Lindsey, who was elected president of the Southeastern Division of the National Electric Light Association at the recent convention held in Chattanooga, is vice-president and general manager of the Durham (N. C.) Public Service Company. Mr. Lindsey came from the legal profession to public utility work back in 1899, first in the management of the old Durham Electric Light & Power Company, later the Durham Traction Company, and its successor, the Durham Public Service Company, which for the past thirteen years has been operated by Henry L. Doherty & Company.

Mr. Lindsey has been prominently identified with every movement for civic betterment in his community for many years and is well known not only in North Carolina but throughout the Southeastern district. The new president was one of the organizers of the Southeastern Geographic Division thirteen years ago and has been an active worker. He has several times been on the executive committee and has acted as vice-president for three or four years.

Everett Moses of Oswego, N. Y., has been appointed general manager of the Sayre (Pa.) Electric Company, succeeding St. Clair Murray, who was recently made manager of the Binghamton (N. Y.) Light, Heat & Power Company. The latter controls the Sayre company.

William Henry Patchell, British consulting engineer and president of the Institution of Mechanical Engineers of Great Britain, sailed for home on the *Homeric*, Saturday, November 7, after his annual sojourn in the United States, where he had been for three months. In addition to keeping in touch with the latest developments in the United States, Mr. Patchell also acts as consulting engineer for a number of American public utilities.

Monroe G. Woolfson, engineer-in-charge of the wire and cable inspection department of the Electrical Testing Laboratories, New York, has sailed for Milan, Italy, to spend several months at the factory of the Pirelli company during the manufacture of the 132,000-volt cable for the new Hell Gate-Dunwoodie lines of the Edison-United distribution system in New York.

H. A. Tepel has been appointed chief engineer of the Dingle-Clark Company, electrical contractors and manufacturers' agents with offices in Cleveland. Mr. Tepel has been assistant chief engineer for this company for the past five years.

T. O. Kennedy, vice-president and general manager of the Ohio Public Service Company, Cleveland, has been elected chairman of the Ohio Committee on Public Utility Information for the ensuing year. Mr. Kennedy has always shown a deep interest in the work of committees on public utility information. He organized the Rocky Mountain committee, and since removing to Cleveland he has been a member of the Ohio committee as well as a member of its editorial committee. **W. W. Freeman**, president of the Union Gas & Electric Company of Cincinnati, has been made treasurer, and **Fred J. Bollmeyer** has been named director of the committee.

D. E. Callender Elected to Vice-Presidency in Wisconsin Utility

D. E. Callender, who has been general manager since 1912 of the Wisconsin Gas & Electric Company's properties, furnishing electric light, electric railway, bus and gas service in eleven counties in southeastern Wisconsin, including the cities of Kenosha, Racine, Waukesha, Watertown, Burlington, South Milwaukee and Cudahy, has been

D. E. CALLENDER

elected vice-president of that company to succeed the late John I. Beggs. Mr. Callender will continue in active charge of the company's affairs under the title of vice-president and general manager. Mr. Callender first entered the public utility field in Wisconsin as an employee of the Racine Gas Light Company in 1901. His accomplishments attracted the attention of his superiors, and in 1908 he was named manager of the company. When that company was consolidated with the Wisconsin Gas & Electric Company in 1912, Mr. Callender became general manager of the properties. The growth of the property and business under his active management has been one of the outstanding successes of public utility development in Wisconsin.

A. C. Engelland has been appointed superintendent of electrical production of the Public Service Company of Northern Illinois to succeed R. A. Whitney, who has been made assistant construction engineer.

Samuel Kahn, vice-president and general manager since 1913 of the Western States Gas & Electric Company, a Byllesby property at Stockton, Cal., has been named vice-president and general manager of the Market Street Railway Company of San Francisco. This announcement came almost immediately after the taking over of the active management of the Market Street Railway by the H. M. Byllesby Company on November 6. Mr. Kahn will retain his position as vice-president of the Western States Gas & Electric Company and also serve on the board of directors.

Obituary

Josiah Francis Johnson, chief engineer of the South Philadelphia works of the Westinghouse Electric & Manufacturing Company, died suddenly in the Chester (Pa.) hospital on November 12. Following graduation from Pennsylvania State College in 1905 Mr. Johnson entered the employ of the Westinghouse company, engaging in the shop testing of steam turbines. Subsequently he served in the capacity of field engineer, assistant district engineer with offices in New York, district engineer of the Rocky Mountain district and first assistant engineer of the steam-turbine department in East Pittsburgh, later becoming engineer of the turbine department and finally manager of the general engineering division. Mr. Johnson was forty-six years of age.

Dr. Harold W. Nichols, a radio research engineer of the Bell Telephone Laboratories, died November 14 at his home in Maplewood, N. J. In July, 1914, Dr. Nichols joined the Bell Telephone Laboratories in New York City, rapidly achieving distinction in the radio research activities of that organization. During recent years he had been prominently identified with the investigations of ship-to-shore radio telephone service and of short waves in radio communication. He took a leading part in the transatlantic radio telephone tests in 1923, and for a lecture on this subject received the Fahie premium from the British Institution of Electrical Engineers. Dr. Nichols was a member of the American Institute of Electrical Engineers, the Institute of Radio Engineers and other technical societies.

George Young Allen, technical assistant to the manager of the radio department of the Westinghouse Electric & Manufacturing Company, was killed November 12 in a railroad accident. Mr. Allen was born in Bernardsville, N. J., in 1893 and was graduated from the Stevens Institute of Technology, Hoboken, in 1915 with a degree of M. E. He engaged in research work for the Western Electric Company after graduation and entered the radio department of the Westinghouse company in 1919. As technical assistant to the manager of that department he was directly concerned with many of the technical developments and commercial applications of radio, especially carrier current. Mr. Allen was a member of the American Institute of Electrical Engineers, the National Electric Light Association, the Institute of Radio Engineers and the Associated Manufacturers of Electrical Supplies.

Commission Rulings

Superimposition of New Holding Company on Existing One Condemned. —The New York Public Service Commission has denied the petition of the Erie Power Corporation for consent to acquire the common stock of the Depew & Lancaster Light, Power & Conduit Company. The action was based, as indicated in the opinion of Chairman Prendergast, on the belief that the Associated Gas & Electric Company was the real party at interest and that the public interest would not be served by superimposing another holding company upon the operating company. "If the original application were made by the Associated Gas & Electric Company to take the Depew company stock," the commission said, "it is not felt, subject to such reasonable conditions as the commission might desire to impose, that there should be any objection to the granting of the petition; but the commission holds that it is not in the public interest to multiply the number of holding companies. The petitioner here is another holding company superimposed upon the Associated Gas & Electric Company. It is not contended that it is an independent holding company, and while it is conceded that the holding company may have a definite and useful place in the financing of public utility operations, this does not justify the organization of unnecessary companies to act in a capacity of holding companies in behalf of holding companies." The opinion also says: "The Associated Gas & Electric Company has in several cases and proceedings before this commission sought to use other companies as vehicles for acquiring the stock of operating companies when there apparently existed no reason why it should not have directly sought such permission itself. The company's witness refused to disclose the price paid for the Depew stock. We are inclined to believe that the nature of such financial transactions is of interest to the public and can see no reason why such information should be withheld. It is not maintained that this commission has any authority to exact information of this kind from a holding company, because under the law it has no control over the operations of holding companies except to consent or refuse to permit them to acquire the properties of operating utilities which are within the jurisdiction of the commission."

Commission Desires Power Over Stock Issues of Holding Companies.— In granting permission to the Power & Electric Securities Corporation of Delaware to buy control of the Malone Light & Power and two other New York State operating companies (see ELECTRICAL WORLD for November 7, page 962, and November 14, page 1022) the Public Service Commission of that state lamented its lack of power to pass upon the stock issues of holding companies. It said: "This commission has been given no jurisdiction over holding companies owning the stock of our domestic operating utilities, and the only corrective it can apply is to refuse permission for the acquisition of the stocks of such operating companies. This Delaware holding company undoubtedly has the legal right to issue its securities on the basis of the amount of money paid for these operating properties and, it may be, on any other basis that its business judgment dictates. Such securities may then be offered in the State of New York and sold in the territory of the local operating companies. And, generally, the public believes that the securities of such holding companies have the authorization of this commission. Nothing can be further from the fact. Our authority is limited to the authorization of the capital issues of the operating utilities alone. When it is possible to secure earnings to justify the prices paid for operating utilities, represented in the capital issues of these holding companies, no harm is done, but there are possibilities of great future losses to the investing public because of the unregulated power of such holding companies to issue their securities and because of the misapprehension of the investing public with regard to those securities. This is pointed out here, not because of its particular application to the instant case, but to call attention again to the fact that the Legislature of the State of New York has not conferred upon this commission the power of regulation over such holding companies to the same extent and for the same reasons that the capital issues of operating companies are now regulated. It must also be remembered in the general discussion of this question, so that too pessimistic a picture of the situation may not be drawn, that the issues of stocks of holding companies do not represent any particular operating company but are applications covering all of the properties of the holding company, and it may well happen, and sometimes does, that while certain of the separate properties of a company cannot pay adequate returns based on the prices paid for them, others will, and the sum total of earnings becomes sufficient to give the expected return."

Unauthorized Transmission Line Interfering with Telephone Line Ordered Reconstructed. — The Missouri Public Service Commission ordered that a 6,600-volt spur line constructed by consumers of the Mound City Electric Light & Ice Company without commission authority and causing interference with a telephone line because of inadequate insulators for the current carried and the lack of circuit breakers in ground guys should be made safe by proper insulation and circuit breakers, and that the part of the line paralleling the telephone line should be moved or changed so that it will no longer cause interference. The commission held further that the question of its jurisdiction over individual defendants need not be decided in a case involving elimination of interference in view of the jurisdiction of the commission over the utility supplying the line with energy.

Recent Court Decisions

Temporary Rates Fixed by Court Not an Infringement on Jurisdiction of Commission. — The United States District Court in Idaho in fixing temporary rates for the Boise Water Company, which had obtained from the Idaho Supreme Court an injunction setting aside an order of the Public Utilities Commission, refused to entertain a contention that for it to act would infringe the jurisdiction of or violate comity with either the Idaho Supreme Court or the commission. The United States court pointed out that there was nothing at issue before the state court, which had discharged its function in issuing the injunction asked for, and that the company had a right to come into the federal courts for relief. "Nor," continued the United States court, "are we able to see how the present suit will in any wise infringe upon the jurisdiction of or interfere with or embarrass the commission in the performance of its proper functions. Upon the other hand, it is our hope that it will proceed with all reasonable dispatch independently and freely to determine the value of plaintiff's property and other requisite factors and thereupon establish or approve a permanent schedule of rates to be charged by plaintiff which will be fair and equitable to all concerned. We are now only protecting property rights until such action can be taken."

Commission Has Power to Change Preferential Rate Secured by Contract. —The United States District Court in California, inquiring into the alteration of a preferential rate by the California Railroad Commission (Market Street Railway Company vs. Pacific Gas & Electric Company) made these decisions: A contract giving a street-railway company a preferential right to be supplied with electricity created no property right by way of easement in the power company's lands. A contract to supply energy in the future is not a sale, but an agreement for sale, and created no interest in property. In view of the power company's charter authorizing it to carry on business as a public utility, its exercise of the power of eminent domain and certain recitals in its preferential contract with the street-railway company, the parties contemplated a dedication by the power company of its property to public use, so that the contract rates were subject to regulation and their change by the commission did not impair the provision giving preferential rates. An attack on the constitutionality of the public utilities act of the state on the allegation that it denies due process by way of a judicial review of commission's orders was overruled, and it was pointed out that the finality of the commission's conclusions on the facts does not extend to the facts necessary to its jurisdiction. (6 Fed. (2d) 633.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Fractional-Horsepower-Motor Market

Motors Cost More to Build but Sell for Less than Fifteen Years Ago—Too Many Manufacturers Trying to Meet Competition of Low-Quality Motors

BY F. W. JESSOP
President Ohio Electric & Controller Company, Cleveland

THE answer to the question "What is the matter with the fractional-horsepower-motor market?" is not a simple one. Any effort toward a solution should be supported not only by manufacturers but also by purchasers of these motors. The question is asked: "Why should fractional-horsepower motors sell for less today than fifteen years ago?" If the fractional-horsepower motor were but recently out of the experimental stage and on a production basis, the answer to the question might be found in improved manufacturing facilities and in volume production.

However, the manufacture of fractional-horsepower motors was on a production basis fifteen years ago; at least, it was on a basis comparable with that of the manufacture of machine tools and motor-driven devices. Since that time the machine tools and devices to which motors have been applied have increased in price from 25 per cent to more than 50 per cent. During this same period the price of fractional-horsepower motors has actually decreased, although every item of expense that goes into their production has increased. Fifteen years ago ¼-hp. motors sold for approximately $11; today they can be purchased for $9.

It is difficult to reconcile this 20 per cent decrease in the price of an electric motor with a 50 per cent increase in the price of a machine tool including the motor. The really shrewd purchaser of motors will recognize in this situation a fact that is true in every other line of business, namely, that "you get what you pay for." It would not be too much to hazard the remark that the ¼-hp motor of today, generally speaking, is worth intrinsically less than the motor bought fifteen years ago. The price has been hammered down, and it is a safe guess that in many cases the quality has gone down with the price. Proper margins of profit, accuracy of machine works necessary to preserve permanent alignment and thorough testing have been sacrificed on the altar of competitive prices.

MASS PRODUCTION AIM OF ALL

Perhaps one of the reasons for this serious condition is the fact that too many motor manufacturers have tried to be the Ford of the electric motor industry. The demand for low-cost motors for certain types of machine tools, such as washing machines and other appliances of a highly competitive nature, has induced many manufacturers to enter the fractional-horsepower-motor field and to try to compete at the low prices demanded by these purchasers of motors in large volume. No one of these industries can ever absorb all of the fractional-horsepower motors that can be made by the present productive capacity of the industry, and for this reason the majority of small motor manufacturers should not attempt to compete in this market unless they are willing to manufacture motors to meet a given price rather than to meet a specification based on sound engineering experience and a liberal factor of safety for long life.

Too many manufacturers apparently assume that the majority of small-motor applications demand low prices, narrow margins of profit and small factors of safety. This is a dangerous assumption and will lead to a discrediting of the small motor by many users having exacting demands. Further, it will lead to overmotoring, with its consequent increase in weight of the completed machine and lower power factor and efficiency in motor operation.

PRICE NEARLY ALWAYS THE SOLE CONSIDERATION

Makers of "quality" fractional-horsepower motors must stick together in their insistence that purchasers give more attention to mechanical and electrical details of construction and less attention to price. The maker of a quality product gains nothing when he sells to a non-discriminating user at a low price. He gains no prestige, because the user cares little for the extra performance; he makes no money, and he makes it more difficult for other manufacturers of quality goods to maintain their prices. Fewer motor manufacturers should be influenced by the prospect of large orders from appliance manufacturers who are not interested in the inherent characteristics of the motor beyond the fact that it shall drive their appliance at a given speed without overheating.

More than one manufacturer of fractional-horsepower motors has been led to expand his manufacturing facilities to meet the production schedule demanded by these appliance manufacturers and to meet the terrible price competition of a dozen other manufacturers, only to find later that this production schedule may suddenly drop to a small percentage of the original. Or at the end of a first-contract period the favored motor manufacturer may find his business suddenly transferred to that of another manufacturer who has quoted a 5 per cent lower price. The first manufacturer may now be in a situation where he must go after business at any price to keep his factory from closing its doors. A year later the second manufacturer may be in the same position as the first, and so on. There may be manufacturers of sufficient resources or temperament to be able to go through with such a cycle of operations and find it agreeable, but let no purchaser fool himself by believing that such a manufacturer is much concerned about the quality of his product or its continuous performance.

Let the manufacturers, who are interested in producing motors to meet rigid specifications, to carry ample factors of safety and to operate at some measure of efficiency and a reasonable power factor, remember that manufacturers of high-class automobiles are not cutting each other's throats to compete in a market that demands low-priced machines.

October Building Contracts Largest on Record

Entire 1924 Building Total Exceeded in Ten Months of This Year—Demand for New Construction Continues Strong

LAST month had the largest October construction volume on record, according to the F. W. Dodge Corporation. Building and engineering contracts awarded during the month in the thirty-six Eastern States, which include about seven-eighths of the total construction volume of the country, amounted to $519,528,200. This was 27 per cent greater than the volume of the previous October. However, there was a 5 per cent decline from September, which is unusual, as October customarily has a somewhat larger building total than September.

The entire construction volume of last year, which was the record year to date, has already been exceeded in the first ten months of this year. Construction started during the past ten months has amounted to $4,846,266,900, compared with $4,479,307,000 for all of last year and with $3,772,593,500 for the first ten months of last year. The increase over the 1924 total has been 8 per cent; over the total for the first ten months of last year, 28 per cent. Four large districts have already exceeded their 1924 totals: New England, the Pittsburgh District, the Central West and the Southeastern States.

The month's record included the following important items: $262,725,500, or 51 per cent of all construction, for residential buildings; $66,006,500, or 13 per cent, for public works and utilities; $63.316,100, or 12 per cent, for industrial buildings; $55,912,100, or 11 per cent, for commercial buildings; and $28,192,000, or 5 per cent, for educational buildings. Contemplated new work reported last month amounted to $839,049,300. This was an increase of 27

per cent over the amount reported in September and 52 per cent over the amount reported in October of last year. This large volume of new work in the plan stage indicates that the demand for new construction continues very strong. October construction contracts in Texas, which is not included in the thirty-six Eastern States, amounted to $10,725,500. Contracts awarded in the other districts for the month of October are as follows: In New England, $38,776,300; New York State and northern New Jersey, $140,918,600; Middle Atlantic States, $51,447,300; Southeastern States, $76,641,700; Pittsburgh district, $78,362,100; the Central West, $126,449,300, and the Northwest, $6,932,900.

McGraw Medal Awarded to W. R. Herstein

Bronze Medal and Purse Presented at Buffalo Convention of Electrical Supply Jobbers' Association—Honorable Mention to Four Other Jobbers for Notable Work

FIVE well-known electrical jobbers received public recognition before the annual winter convention of the Electrical Supply Jobbers' Association at the Hotel Statler, Buffalo, on Thursday of this week in the presentation of the James H. McGraw award, established this year to encourage constructive thinking for the advancement of the electrical industry. The bronze medal and purse of $100 in gold was awarded to William R. Herstein of Memphis, Tenn., and certificates of honorable mention were extended to John L. Buchanan, St. Louis; Robert H. Scott, Atlanta; Sylvester C. Greusel, Milwaukee, and William A. Requa, Rochester, N. Y. The presentations were made by Earl E. Whitehorne, commercial editor of the ELECTRICAL WORLD, in behalf of the committee of awards and were accompanied by the following citations:

William R. Herstein, vice-president Wesco Supply Company, Memphis, Tenn., for many years has devoted much thought and time to the study and discussion of the problem of distribution in the electrical industry. Through correspondence, in published articles, in conferences and in addresses before various groups of electrical men he has worked to focus the attention of the industry on this vital economic issue in order to stimulate intelligent interest and through analysis and argument to clarify the underlying principles on which enlightened policy in the relations between the various branches of the industry must be predicated. Mr. Herstein's long-continued service in this work was dramatically crystallized on October 1, 1924, when he presented before the annual convention of the Association of Electragists International an address on "Distribution from the Standpoint of the Wholesaler" in which he discussed in detail the functional relationships of the electrical contractor-dealer and the jobber and the present conditions that surround them, with particular reference to the declared merchandising policy of the electragists.

John L. Buchanan, president Wesco Supply Company, St. Louis, during the year 1923 became impressed with the possibilities for effecting a practical economy in the distribution of electrical supplies through better methods and standards of packing and carried out in his own business an analysis of unit quantities to determine how best to serve the popular demand as represented by current orders. The results of the study were so interesting that in 1924 he extended the survey to embrace five jobbing houses in Chicago, two in St. Louis, two in Kansas City and three in Omaha. The investigation resulted in the development of new knowledge on the economies of standard units and their packing that made possible many improvements in wholesale practice which have been adopted and applied in manufacturers' shipments to the jobbers.

Robert H. Scott, assistant to the president Carter Electric Company, Atlanta, put into effect a system of sales co-ordination between the jobber and his customers that developed a remarkable degree of co-operation and an unusual amount of sales activity upon the part of the electrical contractor-dealer. The plan organized a sales program to embrace both the jobber and his local outlets, under the direction of the jobbers' sales promotion men, who set up a progressive schedule of advertising and selling that tied in every dealer and contractor on a definite basis and made him a participant in a broad campaign of market building in which the manufacturer, jobber and dealer were all in step. The service was co-operative in character, but above all a demonstration of the broader function and opportunity that awaits the jobber who is willing to make a merchandising institution of his business rather than merely a combination of warehouse and sales office.

Sylvester C. Greusel, president GQ Electric Company, Milwaukee, being convinced of the practical value and importance of establishing a more general use of the Association of Electragists' standard accounting system for contractors and dealers, with the co-operation of the jobbers of Milwaukee established a fund to assist the local contractor-dealers in installing this accounting system, enlisted a large number of them in the movement, employed an accountant to supervise and audit their accounts and, supported by a campaign of educational advertising, carried the work along until, conscious of its value to them, the contractor-dealers themselves assumed the expense. As a result the prosperity and credit standing of the Milwaukee contractor-dealers has been greatly improved.

William A. Requa, president Requa Electrical Supply Company, Rochester, N. Y., seeing the desirability of encouraging his contractor-dealer customers to attend the annual convention of the Association of Electragists, that they might be benefited by a broader viewpoint and become more prosperous, conceived the idea of assuming responsibility as a jobber for financing the cost of the trip by instituting a small monthly charge to the customer's account and impounding the money to be paid over in time to meet the expenses of the convention. In this way he made it easy for additional contractor-dealers to participate in the national association activities and increased the number in attendance.

The James H. McGraw award embraces four medals, one each to the manufacturing, jobbing and contractor-dealer branches of the electrical industry and a medal for co-operation, each accompanied by the purse. The award is to be endowed in perpetuity and will be presented annually, sponsored by the following committee representing the industry: W. W. Freeman, Cincinnati; H. B. Crouse, Syracuse; W. E. Robertson, Buffalo; L. K. Comstock, F. M. Feiker and Earl E. Whitehorne, New York.

The committee of judges which decided the award to jobbers this year included John W. Owen, E. B. Latham & Company; McKew Parr, Parr Electric Company; C. P. Lashelle, W. R. Ostrander & Company, and A. F. Thatcher, Alpha Electric Company.

Ohio Brass Host of McGraw-Hill

SEVERAL executives, members of business staffs and editors of the McGraw-Hill Company were the guests of the Ohio Brass Company on November 16 and 17. A large delegation of McGraw-Hill men arrived at the Barberton plant of the Ohio Brass Company on Monday morning and spent the day with their hosts. A tour of the insulator plant and talks by representatives of the two companies made up the program. A. O. Austin gave a splendid talk on insulators, with some laboratory demonstrations, and in the evening Malcolm Muir gave a talk on "Industrial Marketing" which received many favorable comments.

After spending the night at Akron the hosts and their guests went to Mansfield to visit the Ohio Brass plant in that city. The plant proved very interesting to the visitors. Among the McGraw-Hill men present were Malcolm Muir, Charles Gordon, M. E. Her-

McGRAW-HILL AND OHIO BRASS COMPANY MEN AT BARBERTON PLANT

ring, John Abbink, Jay E. Mason, R. D. Hall, A. H. Hubbell, L. W. W. Morrow, Morris Buck, C. W. Stocks, I. W. Nickel, M. H. Newton and P. H. Graham. Ohio Brass executives who entertained the visitors royally were F. B. Black, C. K. King, A. O. Austin, H. L. Brown, A. D. Lynch, E. B. Snyder, J. R. Palmer, A. L. Price, J. C. Wilson, J. H. Drew and others.

Sales Policy of a Jobber

Plan for Protection of Dealer Co-operating in Sale of Merchandise Announced in Boston

COINCIDENT with its establishment in new quarters at 378 Stuart Street, Boston, the Pettingell-Andrews Company announced last week a sales policy of great significance to the New England electrical trade, with full protection to co-operating dealers. Extracts from the letter sent out by the company announcing its sales policy are as follows:

It is fitting that at the time of our moving into our new building—in reality the starting of a new and larger development of our electrical jobbing business — we should make a definite statement as to our policies. We believe that dealer protection by the distributor and manufacturer is necessary to the prosperity of the electrical industry. Therefore we have been building up, as fast as competition has permitted, a protective policy for the dealer. By the dealer we mean not only the electrical contractor-dealer, but the central-station commercial department and the radio dealer as well.

We have today in active force a definite protective policy on radio for the dealer. No "Radiola" material of any kind is sold by us to other than an established radio dealer. It was comparatively simple to put this policy into effect as the radio industry was a new industry and could be started right. In other commodities of the electrical industry we face greater problems.

We do not sell the consumer any merchandise today with the exception of lighting fixtures, and on lighting fixtures we have a definite policy of protection for the dealer, which is outlined as follows: If the dealer will register the jobs that he is wiring immediately upon his being awarded the wiring contract and will co-operate with us in the sale of the fixtures to the customer he is working for, he will receive protection on each and every job. Any dealer failing to do this loses his chance of protection. It is not our desire to sell fixtures direct, but it is essential in the building up of the fixture business that the consumer have the opportunity to select his lighting equipment to the best possible advantage. That is the whole purpose back of our fixture studios. On large office, public or bank buildings it is impossible to afford protection to the dealer owing to the fact that competition coming from New York and other sections of the country is such that these jobs must be handled direct, except in instances where the dealer may be able to control the situation and co-operate with us in the sale of the job.

A registry card covering other lines than fixtures signifies that you are placing your name on file with us as a dealer who would like to receive any inquiries, orders or other information that would help you in the building up of your business. It is our intention in our new showrooms to interest the consumer whenever possible in electrical household appliances, radio and the proper wiring of the home, and in this way to increase the buying interest of the consumer when you come in contact with him or the work in his house. In each and every case we will refer such inquiries to the local dealer that the consumer expresses a preference for, or furnish him with a list of the dealers that are eligible to perform such work. In the event of our taking orders for electrical household appliances, radio or other materials, such orders will be sent to the local contractor selected by the customer and billed through him. Such inquiries and orders will, of course, have to be referred to the dealer or dealers handling the materials which the customer has selected. Therefore, if you are interested in this protection, you will register with us on the inclosed card as being desirous of having inquiries and prospects referred to you.

Covering the question of the sale of electrical material to the industrials for their own consumption, it is our definite policy to sell direct to all large industrials except in cases where they now find it more economical to purchase through the local dealer. We believe, however, that the small industrial will find it more economical and convenient to purchase through the local dealer, and such a policy is receiving our full indorsement.

Business Conditions

THE electrical industry continues to be active, with the trend upward. This condition is expected to continue until at least the early months of next year. Steady demands are being made by all industry, and central-station companies are purchasing large quantities of supply and distribution material as well as a good amount of auxiliary and substation apparatus. As a whole the industry should show at least a 10 per cent increase in sales this year as compared with last year, despite the comparatively smaller business transacted earlier in the year.

Jobbers are reporting large total sales, though orders are mainly small, and sales are expected to be maintained at least on the same level for the rest of the year. The steel industry is placing orders for quite a large amount of material, and some big orders from that source are expected before the end of the year. Building construction contracts are being executed on a large scale, and production in the steel industry is increasing, with consumption excellent.

In New England there is an upward trend in electric lighting activity and a marked interest in power equipment. The market is generally active, small motors are in steady demand, and industrial heating installations are increasing. Wire and cable sales are very good in the New York district and continue to be well above the figures of last year. Some large orders for central-station equipment are still in prospect, and buying of distribution apparatus and supplies continues in large volume. In the Southeast an improvement is noted in all lines. Increased activities of the small central-station companies in that territory are expected to create a good demand for line and construction materials and distribution transformers. The volume of business in the Middle West is steadily increasing, and sales of distribution equipment continue active. On the Pacific Coast sales are in good volume, especially of seasonable lines. Power-company buying is light, but railroad purchasing is steady, and prospects of business from lumber companies are particularly good.

Non-Ferrous Metal Consumption Continues Unabated

THE present reaction in the non-ferrous metal market appears to be only temporary as the market is now firmer than for a week or two. The good consumption and meager stocks cannot be gainsaid for long. Owing principally to the lack of interest abroad, copper was more insistently offered in the domestic market on Monday and Tuesday, and buyers, sensing this, demanded concessions below the 14⅝ cents offered price for Connecticut and nearby points. One buyer in the Valley was able to get a good tonnage for 14½ cents delivered, though that probably could not have been done in more than one direction. Most sellers are holding at 14⅝ cents, and some are out of the market entirely. Much wire business is in the offing, however, there being twelve to fourteen million pounds in the market in the shape of inquiries yesterday. Buying would no doubt increase considerably if the copper market showed strength, but, even as it is, this week's sales are well above those of last week.

NEW YORK METAL MARKET PRICES

	Nov. 11, 1925 Cents per Pound	Nov. 18, 1925 Cents per Pound
Copper, electrolytic	14⅜	14⅛
Lead, Am. S. & R. price	9¼	9¼
Antimony	20	20
Nickel, ingot	34	34
Zinc, spot	8.95	8⅛
Tin, Straits	62¾	63⅛
Aluminum, 99 per cent	29	29

Base copper price Nov. 18, 1925, 16½ cents

Lead continues to be more freely offered, though spot lead is admittedly rather scarce. Sales have been in good volume during the week and have been well distributed among the various classes of buyers. No reputable buyer should have trouble in getting anything but spot lead at the New York price of the American Smelting & Refining Company, which continues at 9¾ cents. The reaction in zinc seems to have been pretty well arrested. Sales have been good during the week, but mostly for December or January, the prices for those deliveries being from $1 to $3 per ton less than for prompt, the limited supplies of which are very closely held. Very little interest is exhibited in tin these days, and the price has fallen slightly.

Improvement in All Lines Noted in the Southeast

IMPROVEMENT in all lines is reported in the Southeast, with prospects for continued good business into the new year. Purchases of outdoor construction materials by steam railroads continues very satisfactory, and independent telephone companies are also ordering a good volume of supplies to be used in connection with expansion programs. The smaller central-station companies are beginning to show increased activities, and prospects are for reasonably good orders from this class within the next few weeks for line and construction materials and distribution transformers. Jobbers report the receipt of gratifying orders from the re-

tail contractors and dealers for Christmas stocks. One of the large jobbers reports that his entire stock of Christmas novelties has been disposed of and he has reordered in anticipation of still further demands. The expansion on the part of power companies in Alabama and Mississippi is creating a very favorable market for motors and apparatus. While the individual orders are not large, the total volume is satisfactory.

Electric ranges, while not selling so well as in the early fall, continue to be in reasonably good demand, and sales of domestic electric refrigerating machines are holding up remarkably well for this period of the year. The demand for commercial refrigerating equipment is becoming more pronounced and the outlook for this specialty is very good. Florida has added considerable railroad construction to its general line of activities.

Sales in Good Volume on the Pacific Coast

BUSINESS for November seems to be running somewhat above normal on the Pacific Coast, especially in the sale of seasonable lines. It is being carefully followed by jobbers to prevent overstocking and careless use of time-payment plans. The average order is better than was the case last year. Power-company buying has been light, but has included seven carloads of 35-ft. and 40-ft. poles and a large order for construction and line tools.

Railroad buying is steady but running to rather small, well-assorted lots of wiring material. One order covered 2,500 dry batteries. Prospects for business from lumber companies are especially good, there having been no less than three inquiries this past week averaging about $5,000 each for heavy cable for sawmill wiring and for feeders from power house to mill. Mining companies have furnished a couple of similar but smaller inquiries. Country business has also been very good, with several inquiries for small power projects, such as one for about $4,500 of wiring material, including 7,500 lb. No. 6 bare copper wire; one for $2,500 worth of cable and supplies from a land company near Sacramento, and another for $1,200 covering conduit and wire from the Turlock irrigation district. On the Seattle district many orders are expected to be placed soon for weatherproof wire and other distribution material.

Industry Buying Steadily in New York District

THE electrical market in the New York district continues active. Motors and control equipment are in steady demand by industrial firms, and sales of such equipment to date are well ahead of those for the same period last year, despite the fact that the business earlier in the year was comparatively slow. Orders are mainly in small lots, but come from many industries, and indications point to a continuation of good business. Central-station companies continue to purchase distribution and supply material at an increasing rate. Some good orders for apparatus are in prospect, as is also an interesting order for switching equipment. Wire and cable orders aggregate a large volume, and manufacturers are known to be in the market for large quantities of copper to fill current orders. Sales of industrial lighting equipment are active.

Active buying of building construction material is again in full swing after a slight lull in the first two weeks of the month and is now at a high rate. There is a generally increased demand for all lines and jobbers are very optimistic as to the good showing that will be made this quarter.

Lighting and Power Equipment Active in New England

AN UPWARD trend in electric lighting activity and a marked interest in power equipment are especially noted in an active electrical market throughout New England during the past week. Numerous street-lighting projects are reported for this district, and two of exceptional interest are those of Cambridge and Lawrence, Mass. Others are under way in smaller towns and cities. Industrial lighting shows a parallel trend. One prominent central-station company reports more than thirty contracts for industrial lighting now being executed and an encouraging co-operation on the part of contractors and manufacturers. House-wiring contracts show a slight slackening in volume. Negotiations for power equipment are active, with increasing interest in turbo-generator units. One manufacturer reports an order for a 500-kva. unit for New Haven last week; the Connecticut Light & Power Company, Waterbury, is receiving bids for two 1,680-hp. boilers for an addition to the Devon Street plant and plans to purchase a turbo-generator unit early in 1926 with a 25,000-kva. rating or larger.

Small motors are in steady demand, with sales most active in the refrigerating and oil-burning fields for the fractional sizes. Machinery manufacturers are interested in individual drives, and many orders, most of which are in small lots, are reported. Industrial heating shows more strength than for many months. One central-station company reports several recent installations and much activity in the steel-treating trade. The New England Power Company is planning to construct a connecting link with the Boston Edison Company which will extend from Millbury to Medway, a distance of over 14 miles, and cost about $29,300. The Holyoke Street Railway Company plans to electrify the branch steam lines which have been recently acquired serving the towns of Mount Tom and Easthampton.

Sales of Distribution Equipment Continue Active in Middle West

THE volume of business in the Middle West is steadily increasing and a very optimistic tone is evident everywhere. The various utility companies are busy completing construction work started earlier in the year and in expanding their distribution lines. Distribution equipment is still much in demand, one utility placing orders this week for approximately 850 distribution transformers varying in capacity from 10 kva to 200 kva. Several inquiries are reported for quotations covering considerable quantities of busbar copper, wire and cable. There has been quite a good demand for pole-line hardware and insulators.

Jobbers' sales are increasing in volume, appliance sales are increasing and the outlook is for a very busy holiday season. Wiring devices, conduit, and wire, and in fact most commodities, are moving well. It is rumored that pole-line-hardware prices are apt to stiffen at an early date. Sales of cross-arms are fair but are not so great as was expected some months ago. Automatic motor-control equipment is selling well, new applications in the sanitary and hydraulic fields having broadened the possibilities of this class of apparatus.

Activities of the Trade

Safety Cable Company Acquires Control of A-A Wire Company

The Safety Cable Company, 114 Liberty Street, New York, announces that it has acquired all of the common stock and a large portion of the preferred stock of the A-A Wire Company, 401 Kingsland Avenue, Harrison, N. J. All of the active officers of the A-A Wire Company will continue with the Safety company, retaining a substantial interest by the exchange of all of their common-stock holdings of the A-A company for stock of the Safety company.

In the September 26 issue of the ELECTRICAL WORLD it was announced that the Safety Cable Company was the new name of a merger formed by the Safety Insulated Wire & Cable Company, New York, and the Phillips Wire Company, Pawtucket, R. I. The consolidated figures of actual shipments of the three companies now constituting the Safety Cable Company from September 1 to date show an increase over the corresponding period in 1924 of more than 20 per cent.

States Company Reports Growing Sales of Meter-Testing Equipment

Sales of meter-testing equipment this year have trebled those of a year ago, according to H. J. Blakeslee, president of the States Company, Hartford, Conn., and the outlook for 1926 is excellent. The combined lines of this company are now selling at 22 per cent above 1924, and some overtime production has been necessary of late. Additional space has also been occupied in the factory building at 19 New Park Avenue.

Mr. Blakeslee states that the foreign business of the company has been good this year and that attractive orders for phase shifters, load boxes and regulators have been filled for customers in Russia and New Zealand, the former

having been in the market for series lighting cut-outs as well. The Canadian sales of the company have been well maintained this year. Recent substantial domestic orders include one for seven test tables from the Staten Island Edison Corporation and test tables have also been sold to the Consumers Power Company of Michigan. Recently appointed sales representatives of the company are A. A. Barbera, 502 Delta Building, Los Angeles, for southern California, and the Mine & Smelter Supply Company, El Paso, Tex., for western Texas.

Underwriters' Laboratories Report on "Romex" Cable

On November 4 the Electrical Council of Underwriters' Laboratories accepted the recommendation of the laboratories' engineering staff that a notice be issued to the industry advising that "Romex" cable had been examined and tested and found to comply with Underwriters' Laboratories' tentative specifications for non-metallic sheathed cables. The notice also calls attention to the fact that there is now a rule in the Code forbidding the use of twin wires and that the Article 5 committee is now considering necessary installation rules.

Orders Placed for Municipal Power Plant in Detroit

Contract for furnishing the switching equipment for the municipal generating station and three main switching stations, which will furnish power for the Detroit street railways and street-lighting system, has been awarded to the Westinghouse Electric & Manufacturing Company. The contract amounts to approximately $800,000. The Westinghouse company also received orders covering railway substation equipment amounting to $384,000 and turbines amounting to $1,254,000.

Other orders placed include one with the General Electric Company for transformers amounting to $175,000, and one for railway substation equipment amounting to $750,000, another with the Habirshaw Elecetric Cable Company for $780,000, one with the Combustion Engineering Corporation for $428,000 for pulverized fuel equipment and furnace walls, one with the Link-Belt Company for $76,000 for coal-handling machinery, and another with the Wheeler Condenser & Engineering Company for $144,000 for condenser units.

H. T. Herr Takes General Management of Two Westinghouse Plants

H. T. Herr, resident vice-president of the Westinghouse Electric & Manufacturing Company, in charge of the South Philadelphia works, will according to official announcement issued from the main office at East Pittsburgh, hereafter direct the general management of that plant, as well as the Stoker works at Attica, N. Y. Mr. Herr has been head of the South Philadelphia works since they were established in 1918, directing the engineering and production work, and from now on he will direct the sales work as well. The part of the sales force relating specifically to steam equipment will be moved from East Pittsburgh to South Philadelphia and along with the engineering and manufacturing staffs will report to Mr. Herr with the necessary co-operation from East Pittsburgh to unify the central-station representation of the company.

Southern Dairies, Inc., Purchase Large Fleet of Electric Trucks

Another of the big dairy companies of the country has purchased a large fleet of electric trucks to take the place of horses on its retail routes. Following close on the announcement that Borden's Farm Products Company, Bowman Dairy Company, Ira J. Mix Dairy Company and others had adopted electric trucks, Southern Dairies, Inc., of which Edward S. Perot, Jr., is president, has ordered thirty-eight electric trucks for use on their routes in West Palm Beach and Miami, Fla. The trucks are being built in the plant of the Commercial Truck Company, 300 Hunting Park Avenue, Philadelphia, and are of the drop-frame type.

The Servel Corporation, 51 East Forty-second Street, New York, has entered into a contract with the Philadelphia Electric Company, which has instituted a broad-scale merchandising campaign for the education of customers on the advantages of electrical refrigeration. Several appliance dealers, department stores, etc., in Philadelphia will be included in the campaign. Twelve carloads of Servel machines have been shipped to Philadelphia for the sales campaign.

The Delta-Star Electric Company, 2400 Block Fulton Street, Chicago, announces that it has furnished the 13,200-volt outdoor substation equipment supplying the Santa Fé Grain Elevator, Argentine, Kan. This elevator is said to be the second largest grain elevator on this continent and contains one of the first installations of an electric box-car unloader. The transformer equipment, consisting of three 666-kva. units for power and one 50-kva. unit for lighting were furnished by the Moloney Electric Company, St. Louis.

The Westinghouse Electric & Manufacturing Company has acquired a tract of land on Trumbull Street, Detroit, fronting on the line of the Michigan Central Railroad, aggregating about 100,000 sq.ft., and has tentative plans under advisement for a new factory branch, service and distributing works on the site. The proposed structure will cost close to $350,000, with equipment.

Edward T. T. Williams & Associates, 18 East Forty-first Street, New York City, announce that Hoyt Catlin, advertising manager of the Bryant Electric Company, Bridgeport, Conn., has resigned from that organization and on January 1 will enter the advertising agency as associate and production manager.

The Doble Engineering Company, manufacturer of safety insulator testers, switch sticks, etc., has moved its offices and factory from 110 Brookline Street, Cambridge, Mass., to Medford Hillside, Mass. About ten times the floor area of the former establishment is available in the new location, which is adjacent to the Tufts College campus and at the base of the broadcasting station tower, formerly used by the American Radio & Research Corporation.

The Delco-Light Company, Dayton, Ohio, manufacturer of the "Frigidaire" electric refrigerator, farm-lighting plants, etc., has doubled the floor area of its Los Angeles office at 1518 West Pico Street. A rearrangement of its quarters has also been effected to provide additional showroom facilities.

The Killark Electric Manufacturing Company, 3940 Easton Avenue, St. Louis, manufacturer of "Electrolet" conduit fittings, fuses, etc., announces that its new factory building is in course of erection. This building, which is of the modern reinforced concrete type, will contain about 25,000 sq.ft. The company plans to occupy the building in January, 1926.

The Roller-Smith Company, 233 Broadway, New York, announces that its Knoxville (Tenn.) agent, the Tennessee Engineering & Sales Company, has opened a branch office at 493 North Boulevard, Atlanta. All Georgia business will be looked after from the Atlanta office. The company also announces that its New England agent, the Detweiler-Bell Company now has its main office at 101 Milk Street, Boston, and has a branch office at 152 Temple Street, New Haven. Paul G. Detweiler and R. H. McCormick are in the Boston office and F. M. Lord is in the New Haven office.

The Sharples Specialty Company, Twenty-third and Westmoreland Streets, Philadelphia, announces that it is now offering two new models of the Sharples "Super Centrifuge," known as the Nos. 4-A and 5-A machines, having capacities falling between those of other machines now being manufactured by the company.

The General Electric Company has announced a new group life insurance program for the benefit of its 70,000 employees. The total insurance is expected to reach $170,000,000, which, it is said, will constitute the largest and most comprehensive group life insurance program ever underwritten.

The Westinghouse Electric Company of Japan announces that John W. White has been appointed general manager. Mr. White, who has already left for Tokio, has been in the employ of the Westinghouse company for many years and was recently manager of the Westinghouse Electric International Company's branch office at Havana, Cuba.

The Servel Corporation has recently appointed L. W. Driscoll as Southeastern district manager, with offices in the Bona Allen Building, Atlanta.

The Maytag Company, Newton, Iowa, manufacturer of washing machines, has tentative plans for a one-story and basement addition, 190 ft. x 280 ft. on which it expects to begin work early next year. The building is estimated to cost approximately $350,000.

New Trade Literature

ELECTRIC INDUSTRIAL OVENS.—The Thermo Electric Instrument Company, 8 Johnson Street, Newark, N. J., is distributing a leaflet covering the "Freas" thermostatically controlled industrial ovens, which are especially adapted to baking enamels, japans and lacquers, baking armature cores after impregnation, vulcanization of rubber, testing rubber paints, drying leather, etc.

PORTABLE INSTRUMENTS.—The General Electric Company, Schenectady, N. Y., has published bulletin GEA-158, describing and illustrating its type "DP-2" direct-current portable instruments, designed for secondary standards and general testing purposes; also its type "P-3" portable instruments for alternating-current and direct-current service.

BATTERY-CHARGING EQUIPMENT.—Bulletin No. 69 issued by the Ward Leonard Electric Company, Mount Vernon, N. Y., describes various types of its "Vitrohm" battery-charging equipment.

BOILER.—The Edge Moor Iron Company, Edge Moor, Del., has issued a booklet describing the "Edge Moor" single-pass boiler. The booklet contains a complete description of the operation and performance of the boiler, including draft loss-rating curves. The construction of this boiler and its relation to the boiler house is discussed and the method of rating is explained. A recapitulation of the principal features of the boiler is arranged in groups for convenient reference under the headings of "general design," "structural features," "features affecting building construction" and "unusual operating features."

ALLOYS.—"The Right Alloy in the Right Place" is the title of a bulletin issued by Arlington Bensel, 300 Madison Avenue, New York City, exclusive sales agent for Victor Hybinette, Wilmington, Del. The bulletin describes the "Hybnickel" series of alloys and contains typical illustrations showing the application of various "Hybnickel" alloys for extreme service.

RESIDENCE PANELBOARDS.—A leaflet issued by the Trumbull Electric Manufacturing Company, Plainville, Conn. (insert for catalog 13), describes its "Circle T" residence panelboards.

POLYPHASE TRANSFORMER.—Bulletin No. 2,049, distributed by the Pittsburgh Transformer Company, Pittsburgh, covers the Pittsburgh polyphase transformer with expansion tank and film-type radiator.

ELECTRIC CLEANER.—The P. A. Geier Company, 540 East 105th Street, Cleveland, has issued a sales manual entitled "Royal Sales Methods," a "handbook of success," which covers the subject of house-to-house salesmanship.

AUTOMATIC CHANGE-OVER SWITCH.—Leaflet L-20,234, distributed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates its type "M" automatic change-over switch, designed to give continuity of service. It contains an outline of the construction and describes the application and distinctive features of the switch.

OUTDOOR STATION EQUIPMENT.—The General Electric Company, Schenectady, N. Y., is distributing bulletings GEA-52 and GEA-53, describing and illustrating respectively its outdoor station equipment for 22,000, 33,000 and 44,000-volt service, 750 kva. to 3,000 kva., three-phase, and "G-E" busbar clamps and terminals for outdoor station equipment.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Copenhagen, Denmark (No. 17,643), of radio "B" batteries and lead grids for storage batteries.

An agency is desired in Mexico City, Mexico (No. 17,640), for electric bulbs for automobiles.

Purchase and agency is desired in Berlin, Germany (No. 17,646), for electric motor-driven household devices.

An agency is desired in Bucharest, Rumania (No. 17,645), for radio sets.

An agency is desired in Vancouver, B. C. (No. 17,623), for radio sets and parts. Purchase and agency is also desired (No. 17642), for radio sets and parts.

Purchase is desired in Stavanger, Norway (No. 17,641), of electric refrigerators.

Purchase is desired in Asuncion, Paraguay (No. 17,610), of six electric cranes.

Sole agency is desired in Bombay, India (No. 17,634), for oil engines.

An agency is desired in Vienna, Austria (No. 17,611), for steam engines and turbines, and indicators for boiler room.

An agency is desired in Cairo, Egypt (No. 17,652), for motor pumps for irrigation purposes.

Purchase and agency is desired in Bandon, Ireland (No. 17,723), for electric trucks or truck chassis.

An agency is desired in Fiume, Italy (No. 17,724), for electric automatic windshield wipers.

An agency is desired in Vancouver, B. C. (No. 17,742), for barbers' electric hair clippers.

An agency is desired in Rio de Janeiro, Brazil (No. 17,798), for radio sets and parts.

Purchase is desired in Vienna, Austria (No. 17,741), for electric water heaters.

CABLE, LAMPS, SWITCHES, ETC., FOR MONTEVIDEO.—Tenders will be received by the State Electricity Supply Works, Montevideo, Uruguay, until Jan. 12, 1926, for 44,500 metallic and carbon filament lamps. Bids will also be received until Jan. 29, 1926, for lead fuse wire, enameled lamp shades, cut-outs, switches, lamp holders, sockets, rubber tape, etc.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

BOSTON, MASS. — The New England Telephone & Telegraph Company, 119 Milk Street, Boston, is considering installing underground cables between its central offices in the city proper.

BOSTON, MASS.—Plans have been filed by the Hunt-Spiller Manufacturing Corporation, 383 Dorchester Avenue, for a power plant at its mechanical works, to cost about $45,000.

HOLYOKE, MASS.—The Holyoke Water Power Company has applied to the City Council for permission to build an addition to its No. 1 plant on the river bank, between Appleton and Mosher Streets, to cost about $8,000.

MILLBURY, MASS.—The New England Power Company, Worcester, has petitioned the Department of Public Utilities for permission to erect a 13-mile high-tension line from its substation at Millbury to connect with the transmission lines of the Edison Electric Company at Milford and Medway. The cost is estimated at $432,635.

SPRINGFIELD, MASS. — Bids, it is understood, will soon be asked by the Boston & Albany Railroad, Boston, for electric interlocking switching equipment in connection with local track improvements.

WORCESTER, MASS.—The City Council has authorized the installation of additional lamps on a number of streets. An arc lighting system has been approved for Providence Street.

GOSHEN, CONN. — The Litchfield (Conn.) Electric Light & Power Company plans to erect a transmission line to Goshen to furnish electrical service here.

TORRINGTON, CONN.—The City Council has authorized extensions to the street-lighting systems on Smith and Eagle Streets, Harwinton and Laurel Hill Avenues.

Middle Atlantic States

AKRON, N. Y.—A power plant will be built at the local cement mill, now under construction by the Louisville Cement Company. J. W. Cowper Company, Buffalo, is general contractor.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company has petitioned for authority to extend its transmission to Arcade and Centerville to supply electricity in both towns.

LYONS, N. Y. — Permission has been granted to the Empire Gas & Electric Company, Geneva, to extend its electric service to the town of Lyons.

NEW YORK, N. Y.—Bids will be received by the New York State Bridge and Tunnel Commission and the New Jersey Interstate Bridge and Tunnel Commission, Room 3004 Woolworth Building, until Dec. 15, for furnishing and installing three-conductor lead covered cables in two tunnels and in the ventilating buildings for the distribution of electrical energy for power and light purposes, known as contract No. 20 for the Holland Tunnel. For details see Searchlight Section.

NORTH TONAWANDA, N. Y.—Plans for rebuilding the lumber mill of the W. G. Palmer Company, recently destroyed by fire, include a power plant.

OLEAN, N. Y.—The Pennsylvania Railroad Company, Pennsylvania Terminal, New York, plans to install electric power equipment in the proposed addition to its local locomotive repair shops, to cost about $215,000.

PITCAIRN, PA. — The City Council is arranging to purchase current from an outside source for commercial purposes to be distributed by the muncipality. Extensions and improvements will be made in the municipal system.

SYRACUSE, N. Y.—Plans for the proposed lumber mill and woodworking plant to be erected by the Elgin A. Simonds Company, 17 North Clinton Street, to cost about $100,000, include a power plant. The J. D. Taylor Construction Company, Syracuse, has the general contract.

HARRISBURG, PA.—The City Council is considering the installation of an ornamental lighting system on Front Street, and also the erection of a central station for the police and fire-alarm systems.

PHILADELPHIA, PA. — The Philadelphia Electric Company plans to erect a transmission line from its power plant at Beach and Palmer Streets to the northeastern section of the city.

SAYLORSBURG, PA.—The Pennsylvania Edison Company, Easton, which recently acquired the property of the Saylorsburg Light & Power Company, contemplates extensions to its transmission lines in this section.

HUNTINGTON, W. VA.—The Consolidated Power & Light Company plans to install an improved street-lighting system.

PARKERSBURG, W. VA.—The Viscose Company, Marcus Hook, Pa., plans to build a power plant at its proposed local artificial silk mill, to cost about $1,000,000. The Ballinger Company, Twelfth and Chestnut Sts., Philadelphia, is architect and engineer.

RICHMOND, VA.—The Liggett & Meyers Tobacco Company, 212 Fifth Avenue, New York, plans to install electric power equipment in the proposed addition, for the Allen & Ginter Division, to cost about $500,000. Francisco & Jacobus, 511 Fifth Avenue, New York, are architects.

WASHINGTON, D. C.—Bids will be received by the Director of Purchase and Sales, Department of Agriculture, Washington, until Dec. 4, for two complete electrically driven mechanical fans, and for two complete electrically driven ventilating units.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Nov. 24 for electric soldering irons, percolators and glue pots, radio transmitters, etc., for the Navy Supply Depot, Brooklyn, N. Y.

North Central States

IRONWOOD, MICH.—The City Council is considering extensions to the street-lighting system.

JACKSON, MICH. — The Consumers Power Company plans to build a new electrical and mechanical shop, and experimental laboratory.

LANSING MICH.—The City Council is planning to install an underground transmission line (13,000 volts) for service in the downtown district, at a cost of about $55,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Nov. 27, for high-pressure steam piping for the Division of Light and Power.

CLEVELAND, OHIO.—The City Ice & Fuel Company plans to install electric power equipment in connection with extensions and improvements in its ice-manufacturing plants at Cleveland, Cincinnati and Columbus, Ohio, Kankakee, Ill., and Lakeland, Fla. The cost is estimated at $1,500,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of

Purchases and Supplies, City Hall, until Nov. 27 for ornamental lamp standards for the Division of Light and Power. Bids will also be received at the same time and place for ornamental lanterns for the Division of Light and Power.

STRUTHERS, OHIO.—The Pennsylvania-Ohio Power & Light Company, Youngstown, has applied for permission to erect a steel-tower transmission line over the Mahoning River.

SUMMITVILLE, OHIO.—Plans for rebuilding the factory of the Summit Brick Company, recently destroyed by fire, include a power plant.

YOUNGSTOWN, OHIO. — Bonds to the amount of $5,000 have been authorized for the installation of seventeen additional fire-alarm boxes and extension of the fire-alarm system.

HARTFORD CITY, IND. — Plans are under way by the Hartford City Paper Company for a turbine station at its plant. The Green Engineering Company, General Motors Building, Detroit, is engineer.

INDIANA HARBOR, IND.—The Youngstown (Ohio) Sheet & Tube Company plans to install electric power equipment at its proposed local steel mill to cost about $5,000,000. An electric power plant is said to be under consideration.

INDIANAPOLIS, IND. — The Board of Works has authorized extension of the new lighting system into the Norwaldo addition, north of the city, also from Meridian Street to Boulevard Place in Fifty-second Street and in Capitol Avenue from Forty-sixth Street to Fifty-second Street.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company has plans in preparation for remodeling a local six-story building and will convert it for a modern substation. A list of equipment to be installed will soon be made. Charles Brossman. Merchants Bank Building, engineer.

CHICAGO, ILL. — The C. E. Peterson Company, 4914 Wentworth Street, plans to install electric power equipment at its proposed sash and door mill to be erected at Hoyne Avenue and Eighty-second Street, at a cost of about $300,000.

BELOIT, WIS. — Plans have been approved by the City Council for the installation of an electric traffic signal system in the downtown section.

EAU CLAIRE, WIS. — The Northern States Power Company of Wisconsin, Chicago, does not contemplate the construction of a hydro-electric power plant at Elk Creek, as reported in the issue of Oct. 31. The company is planning to establish a summer resort at Elk Creek.

MILWAUKEE, WIS.—Plans have been prepared for a power plant and laundry for the Milwaukee Hospital, Twenty-second and Cedar Streets, to cost $60,000. R. Cramer, 1105 Vliet Street, is engineer.

RED WING, MINN.—The City Council has preliminary plans under consideration for extensions and improvements in the street lighting in the business district.

AUDUBON, IOWA. — The Iowa Light, Heat & Power Company, Carroll, is considering the installation of additional equipment in its local power plant.

DES MOINES, IOWA.—The installation of electroliers in the business district, to cost about $73,000, is under consideration by the Council.

MUSCATINE, IOWA.—The City Council is said to be arranging a bond issue of $375,000, the proceeds to be used for extensions in the municipal electric lighting plant and system.

ST. CHARLES, MO.—The City Council is considering the installation of a municipal fire-alarm system with central station, to cost about $30,000.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service, City Hall, until Dec. 15 for installing a street-lighting system in districts B, C and D, the work to include 9,367 reinforced concrete standards complete with fixtures and luminaires; 1,250,000 ft. of trenching and backfill, 2,000,000 ft. No. 8 steel-taped cable, 100,000 ft. 5,000 volt, lead-covered primary cable, three substations, one equipped with fourteen transformers, etc., and two with twelve transformers. The cost is estimated at $1,250,000. R. Toensfeldt is engineer.

SIOUX FALLS, S. D.—A special election will be held Nov. 24 to vote on two proposed bond issues, one for $300,000 to enlarge the municipal electric plant, to replace the issue voted in 1918, which was recently invalidated by the State Supreme Court, the other for $600,000 for building a sewage disposal plant.

STRATTON, NEB. — The City Council plans the installation of an improved lighting system on Bailey Street.

Southern States

ROCKY MOUNT, N. C. — The Atlantic Coast Line Railroad Company, Wilmington, plans to install electric power equipment in connection with the rebuilding of its local car shops, recently destroyed by fire, with loss of about $200,000.

SEABOARD, N. C.—The City Council is considering the installation of an electric light and power system.

TIFTON, GA.—A special election will be held on Dec. 10 to vote on the proposal to issue $10,000 in bonds for extensions and improvements in the street-lighting system.

WRIGHTSVILLE, GA. — The Georgia Southern Power Company, Washington, D. C., which has acquired the municipal electric plant, plans extensions in its transmission lines for local service.

BALDWIN, FLA.—The Florida Power & Light Company, West Palm Beach, plans to erect a transmission line to Baldwin and to build a power plant and distributing system here. Service will also be supplied at MacClenny.

DAYTONA BEACH, FLA.—The Florida Textile Products Company, Inc., recently organized, plans to install electric power equipment at its proposed local mills, to cost about $500,000.

JACKSONVILLE, FLA.—Ernest L. Hill, president of the Ernest L. Hill Realty Company, is at the head of a project to construct and operate two or more hydro-electric power plants on the St. Mary's and Suwanee Rivers, with estimated gross production of 200,000 hp. and cost reported at close to $10,000,000. Application for permission has been made and hearing will be held on Nov. 24. A company will be organized to carry out the project. C. Lyman Spencer, president, South Development Company, Jacksonville, is also interested.

LAKE WORTH, FLA. — The Municipal Light & Water Department plans to erect a transmission line to Boynton to furnish service in this section.

LANTANA, FLA.—The City Council is considering a bond issue of $55,000 for the installation of an improved street-lighting system.

ST. PETERSBURG, FLA.—The Department of Public Utilities plans to install an improved lighting system on South Fourth Street.

TAMPA, FLA.—Plans for the proposed local cement mill to be built by the Tampa Portland Cement Company, recently organized, to cost about $900,000, include a power house.

DUCKTOWN, TENN. — The Ducktown Chemical & Iron Company plans to install electric power equipment in connection with proposed extensions and improvements, to cost about $300,000.

ERIN, TENN.—The erection of a 33,000-volt transmission line from Erin to Clarksville, and thence to Palmyra and Cumberland City and possibly to Dickson, is under consideration by the Erin Utilities Company. An extension from Hermitia through Slayden, Vanleer, Charlotte, Cumberland, Furnace, Sylvia and other places, it is reported, is also contemplated.

NASHVILLE, TENN.—At an election to be held Dec. 17 the proposal to issue $100,000 in bonds, the proceeds to be used for extensions to lighting system, will be submitted to the voters.

LESLIE, ARK. — The property of the Barnett Light & Power Company has been acquired by new interests, headed by E. T. Stanfield. Extensions and improvements, including the erection of additional transmission lines, are contemplated by the new owners.

TEXARKANA, ARK.—Steps have been taken by the Kiwanis Club for the installation of an ornamental lighting system on Broad Street.

EUNICE, LA. — The municipal electric plant has been acquired by the Louisiana Public Service Company, New Iberia, which plans to erect a 33,000-volt transmission line from Ville Platte to Eunice. A transmission line will also be built to Mamou.

CHICHASHA, OKLA. — The Chickasha Gas & Electric Company plans to erect a 9-mile transmission line from Minco to Union City with a distribution system in Union City, to cost about $27,000. F. D. Shafer, Chickasha, is engineer.

TISHOMINGO, OKLA.—The Oklahoma Gas & Electric Company, Oklahoma City, has plans under way for extensions and improvements in its local electric power plant, including the installation of additional equipment. The company recently took over the power and ice utilities at this place.

CLARKSVILLE, TEX.—The City Council has authorized the installation of sixty additional street lamps throughout the city.

FORT WORTH, TEX.—The Fort Worth Power & Light Company plans to build an equipment storage and operating building, to cost about $50,000.

SAN MARCOS, TEX.—Plans are being considered by the Texas Public Utilities Company for the erection of a high-tension line from San Marcos to Martindale, Maxwell, Reedville and other towns, to cost about $100,000.

SAN SABA, TEX.—The Texas Power & Light Company, Dallas, which has acquired the plant of the San Saba Light & Ice Company, plans extensions and improvements in the local station.

SINTON, TEX.—Bids will soon be asked by the Sinton Electric & Ice Company for an ice plant of thirty tons capacity, to cost about $100,000.

Pacific and Mountain States

BELLINGHAM, WASH.—The Olympic Portland Cement Company, Marietta Road, plans the installation of electric power equipment in connection with proposed extensions in its mills, estimated to cost $360,000.

KELSO, WASH.—The City Council has authorized extensions and improvements in the street-lighting system.

ALBANY, ORE.—The City Council has tentative plans for extensions in the street-lighting system, including improvements in present installation.

LA GRANDE, ORE.—The City Council is considering the installation of an improved lighting system on Adams Avenue. The city engineer is in charge.

ARTESIA, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the downtown district.

BEVERLY HILLS, CAL. — The Hollywood-Redondo Boulevard Association is considering the installation of ornamental lamps on the Preuss Road.

CULVER CITY, CAL.—The City Council plans to install an ornamental lighting system on Venice Boulevard, between the Walnut Grove Terrace and Girard Avenue, and on portions of other streets.

HEMET, CAL. — The Board of City Trustees plans to install ornamental lamps on portions of Florida Avenue, Harvard Street and other streets, requiring fifty-nine concrete standards.

LOS ANGELES, CAL.—The installation of ornamental lamps on various streets, covering about 5½ miles, is under consideration.

LOS ANGELES, CAL.—The City Council plans the installation of an ornamental lighting system on Hope Street from Sixth to Washington Street, using pressed-steel standards.

PASADENA, CAL.—Petitions asking for the installation of ornamental lamps on portions of North Michigan Avenue, and California Street, North Madison Avenue have been submitted to the City Directors.

RIVERSIDE, CAL.—The Board of City Trustees has rejected all bids submitted for an ornamental lighting system on Magnolia Avenue from Galloway to Castleman Street. New bids, it is understood, will soon be called for.

SALINAS, CAL.—The Coast Valleys Gas & Electric Company is considering the construction of a substation at Monterey, to cost about $100,000, and also at Carmel, to cost $37,000.

SAN DIMAS, CAL.—The City Council is considering the installation of an ornamental lighting system on Bonita Avenue, Depot and First Streets, and neighboring streets in the downtown section.

TURLOCK, CAL.—The Turlock Irrigation District plans extensions in transmission lines, to cost about $30,000.

Canada

TIMMINS, ONT.—Bonds to the amount of $6,000,000 have been authorized, of which $4,500,000 will be used for refunding purposes and the remainder for the erection of transmission lines in Rouyn and Gowganda.

QUEBEC, QUE.—The installation of a new fire-alarm system, to cost $253,000, is under consideration by the fire committee.

Electrical Patents

Announced by U. S. Patent Office

(Issued October 20, 1925)

1,558,971. LOCOMOTIVE; S. W. Farnham, Chicago, Ill. App. filed Dec. 26, 1924. Mine locomotive.

1,558,982. SAFETY COVER FOR ELECTRIC SWITCHES; D. Hane, Pittsburgh, Pa. App. filed Sept. 7, 1923.

1,559,002. ELECTRIC HEATER; M. R. Plastino, Spokane, Wash. App. filed July 21, 1924. As applied to motor-operated mixing devices for use at soda fountains.

1,559,015. WELDING ROD; W. F. Stoody, Whittier, Cal. App. filed July 9, 1925.

1,559,017. ELECTRICAL POWER TRANSMISSION SYSTEM; A. M. Taylor, Erdington, England. App. filed Jan. 16, 1925. Method of supplying charging currents.

1,559,022. THERMOSTAT; R. J. Wensley, Edgewood Park, Pa. App. filed Dec. 10, 1919. For protecting machine parts.

1,559,030. CYLINDER SWITCH WITH NO VOLTAGE OR OVERLAP CURRENT RELEASE; R. T. Bar and K. Bölte, Frankfort-on-the Main, Germany. App. filed Aug. 29, 1921.

1,559,085. PERMEAMETER; S. L. Gokhale, Schenectady, N. Y. App. filed Dec. 13, 1923.

1,559,102. LIMIT STOP FOR ELECTRIC HOISTS; F. H. Howard, Reading, Pa. App. filed Feb. 14, 1925.

1,559,103. FREQUENCY CHANGER; J. I. Hull, Schenectady, N. Y. App. filed Feb. 9, 1924. Rotary type.

1,559,110. MOTOR CONTROLLER; G. Leddick, Schenectady, N. Y. App. filed April 25, 1921. Across-the-line type for squirrel-cage motors.

1,559,116. WAVE GENERATING AND MODULATING SYSTEM; W. A. Marrison, East Orange, N. J. App. filed Oct. 16, 1924.

1,559,122. METHOD OF CONNECTING ALTERNATING-CURRENT COMMUTATOR MOTORS; P. Müller, Charlottenburg, Germany. App. filed May 19, 1922.

1,559,137. TELEPHONE-EXCHANGE SYSTEM; H. G. Webster, Chicago, Ill. App. filed June 10, 1907. Combined manual and automatic operation.

1,559,138. AUTOMATIC TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 26, 1907.

1,559,157. ELECTRIC SWITCH; G. A. Burnham, Saugus, Mass. App. filed Jan. 29, 1920. Oil-immersed.

1,559,159. TELEGRAPH SIGNALING SYSTEM; J. R. Carson, Montclair, N. J. App. filed July 7, 1920.

1,559,182. DYNAMO-ELECTRIC MACHINE; C. W. Rice, Schenectady, N. Y. App. filed Nov. 23, 1923. Having a closed ventilating system in which a gas lighter than air, such as hydrogen, is circulated and recirculated for the purpose of cooling.

1,559,205. ELECTRIC SWITCH; H. Trencham, Ruislip, England. App. filed Nov. 6, 1923. High-tension oil switch of the inclosed type.

1,559,225, 1,559,226. ELECTRICAL FUSE; H. Davies, Philadelphia, Pa. App. filed Jan. 26, 1920. Renewable.

1,559,227. LAMP-SOCKET FIXTURE; F. L. Potterie, Brooklyn, N. Y. App. filed Sept. 9, 1924.

1,559,244. TELEPHONE-EXCHANGE SYSTEM; E. S. Gibson, Ridgewood, N. J. App. filed Aug. 10, 1923. Machine switching.

1,559,246. SIGNALING APPARATUS; A. F. Gilson, Oradel, N. J. App. filed July 31, 1923. Amplifying apparatus for telephone currents.

1,559,250. ELECTRICAL PLUG SWITCH; L. N. Hampton, New York, N. Y. App. filed Dec. 21, 1920. As employed in telephone offices for testing.

1,559,251. PRIVATE-BRANCH-EXCHANGE SENDER CIRCUIT; R. W. Harper, East Orange, N. J. App. filed June 13, 1924.

1,559,269. TELEPHONE-EXCHANGE SYSTEM; W. H. Matthies, Hackensack, N. J., and W. P. Albert, East Orange, N. J. App. filed Nov. 30, 1923. Automatic.

1,559,273. OUTLET-BOX STRUCTURE; J. Morgenstern and J. G. Raquette, Cleveland, Ohio. App. filed Sept. 11, 1922.

1,559,280. ELECTRON DISCHARGE DEVICE; V. L. Ronci, Brooklyn, N. Y. App. filed March 23, 1923.

1,559,295. FREQUENCY CONVERTER; H. M. Stoller, New York, N. Y. App. filed Sept. 20, 1916. Static or transformer type.

1,559,297. TELEPHONE SYSTEM; W. P. Albert, East Orange, N. J. App. filed Oct. 26, 1923. Machine switching.

1,559,305. RELAY; W. O. Beck, Ridgefield, N. J. App. filed March 22, 1924. Multiple-switching relay.

1,559,312. ELECTRIC SIGNAL RECEPTACLE; J. O. Cadieux, Meriden, Conn. App. filed Sept. 13, 1923. For use in hospital-calling system.

1,559,325. MEANS FOR ANALYZING OR SYNTHESIZING ELECTRIC WAVES; F. B. Jewett, Short Hills, N. J. App. filed Dec. 20, 1919. In signaling system.

1,559,329. ELECTRIC CIRCUIT SWITCH; N. Lemlyn, Brussels, Belgium. App. filed June 24, 1924. Quick break.

1,559,349. ELECTRICAL CONNECTION; W. R. Mott, Decorah, Iowa. App. filed March 25, 1922. In which a metallic oxide, especially lead dioxide, is one of the connected elements.

1,559,360. METHOD OF AND MEANS FOR ELECTRIC WELDING; A. E. Paige, Philadelphia, Pa. App. filed March 8, 1922. Constant-potential direct current.

1,559,361. STORAGE-BATTERY CHARGING PLUG; W. D. Parker, Cleveland, Ohio. App. filed Aug. 21, 1920.

1,559,371. AUTOMATIC-TELEPHONE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed June 11, 1920.

1,559,372. TELEPHONE-EXCHANGE SYSTEM; W. T. Powell, Rochester, N. Y. App. filed Jan. 4, 1921. Automatic.

1,559,385. DOUBLE-VOLTAGE SYSTEM; W. A. Turbayne, Niagara Falls, N. Y. App. filed Jan. 17, 1921. Involving translation circuit-regulation means.

1,559,389. APPARATUS FOR CONTROLLING ELECTRIC CIRCUITS; A. E. Waller, Bronxville, N. Y. App. filed April 7, 1922. As in theater-dimming apparatus.

1,559,396. LOADING COIL CASE AND THE LIKE; C. R. Young, Bloomfield, N. J. App. filed Dec. 28, 1918. For sealing and protecting the apparatus.

1,559,404. HIGH-TENSION ELECTRICAL CONDENSER; P. Bunet, Moissy-Cramayel, France. App. filed April 14, 1921.

1,559,436. DYNAMO-ELECTRIC MACHINE; H. C. Jacoby, London, England. App. filed March 12, 1925. Inclosed type.

1,559,437. DOUBLE-IMAGE RADIO PICTURE; C. F. Jenkins, Washington, D. C. App. filed May 5, 1925.

1,559,447. LIQUID ELECTRODE; O. Meyer-Keller, Lucerne, Switzerland. App. filed Aug. 12, 1921. For continuous heaters.

1,559,460. ELECTRON TUBE; S. Ruben, New York, N. Y. App. filed June 30, 1920.

1,559,473. LIQUID RHEOSTAT; H. A. Taylor, Watertown, N. Y. App. filed July 8, 1924.

1,559,497. SELECTIVE SIGNALING DEVICE; W. T. Baker, Westwood, N. J. App. filed April 10, 1925. For use with telegraphic and telephonic signals.

(Issued November 3, 1925)

1,559,580. SWITCH AND FUSE MOUNTING; T. E. Murray, Jr., Brooklyn, N. Y. App. filed Jan. 6, 1923.

1,559,638. WAVE FILTER; W. H. Martin, New York, N. Y. App. filed April 26, 1920.

1,559,641, 1,559,642. SIGNALING WITH PHASE REVERSALS; H. Nyquist, Elmhurst, N. Y. App. filed Aug. 28, 1923. Transmission of telegraph signals.

1,559,656. METHOD OF AND MEANS FOR INCREASING VOLTAGES; I. J. Thorp, Maplewood, N. J. App. filed April 26, 1921. The amplification of low-frequency currents.

1,559,659. SERVICE-OBSERVING EQUIPMENT FOR AUTOMATIC TELEPHONE SYSTEMS; J. N. Walters, East Orange, N. J. App. filed June 27, 1923.

1,559,669. LIGHTING-FIXTURE HOLDER; H. M. Brown, Chicago, Ill. App. filed Sept. 26, 1924.

1,559,674. COLOR-MOTION-PICTURE PHOTOGRAPHY; A. W. Carpenter, New York, N. Y. App. filed Jan. 18, 1923.

1,559,684. SOCKET; H. A. Douglas, Bronson, Mich. App. filed Oct. 20, 1923. Adapted to receive a smaller plug.

1,559,693. ELECTRIC CONTROL SYSTEM; J. C. Hale, Tarrytown, N. Y. App. filed Nov. 2, 1921. Electric translating device.

1,559,700. ELECTRICAL-CURRENT-OPERATED CONTROLLING MECHANISM; L. B. Hewitt, London, England. App. filed Aug. 22, 1923. For electric vehicles, motor-control systems, etc.

1,559,714. ART OF RELEASING ELECTRONS IN VACUUM-DISCHARGE DEVICES; J. E. Lilienfeld, Leipzig, Germany. App. filed March 8, 1920.

1,559,715. HIGH-VACUUM TUBE; J. E. Lilienfeld, Kew Gardens, N. Y. App. filed Sept. 29, 1921.

1,559,736. SECONDARY TRUNKING SYSTEM; J. I. Bellamy, Chicago, Ill. App. filed May 17, 1923. Used in automatic and semi-automatic telephone systems.

1,559,738. AUTOMATIC SWITCH; C. P. Brockway, Toledo, Ohio. App. filed June 21, 1919. As used in storage-battery-generator lighting plant.

1,559,743. RADIO-RECEIVING SYSTEM; H. J. de Bellescize, Paris, France. App. filed Aug. 29, 1921.

1,559,745. LIGHTER FOR CIGARS, PIPES AND THE LIKE; F. B. Farnsworth, Granby, Quebec, Canada. App. filed Sept. 27, 1923.

1,559,746. APPARATUS FOR PRODUCING HIGH-VOLTAGE CURRENTS FOR MEDICAL TREATMENT; E. Geissler, Munich-Laim, Germany. App. filed Nov. 11, 1924.

1,559,753. SIGNALING SYSTEM; J. W. Horton, Bloomfield, N. J. App. filed Jan. 6, 1923.

1,559,760. SANDWICH TOASTER; M. Murphy, Rushville, Ind. App. filed June 16, 1925.

1,559,769. ELECTRODE FOR UNIPOLAR HIGH-FREQUENCY THERAPEUTIC TREATMENT; W. Otto, Berlin, Germany. App. filed May 17, 1923.

1,559,770. TRANSMITTING MEANS FOR ULTRA-VIOLET RAYS; R. G. Paddock, San Francisco, Cal. App. filed Sept. 17, 1921.

1,559,776. THERMIONIC REPEATER OR OSCILLATOR CIRCUITS; H. S. Read, New Haven, Conn. App. filed Dec. 9, 1919.

1,559,799. MANUFACTURE OF TUNGSTEN; C. J. Smithells, Oxhey, England. App. filed June 5, 1922.

1,559,802. ELECTRICAL SWITCHING CIRCUITS; G. H. Stevenson, Rye, N. Y. App. filed May 16, 1921. For devices designed to change the characteristics of electrical circuits.

1,559,814. MOTOR CONTROLLER; H. L. Van Walkenburg, Milwaukee, Wis. App. filed June 27, 1925.

1,559,832. ELECTRIC CONTROLLER; D. C. Wright, Euclid, Ohio, and P. V. Tippet, Cuyahoga Falls, Ohio. App. filed April 13, 1925. For motors.

1,559,847. ELECTRICAL TRANSMISSION OR REPRODUCTION OF SOUND; S. G. Brown, North Acton, England. App. filed May 29, 1922.

1,559,850. TRANSMISSION SYSTEM; W. L. Casper, Brooklyn, N. Y. App. filed April 8, 1922. For repeating systems employing electric discharge devices.

1,559,857. LIGHTNING ARRESTER; E. A. Everett, Long Island City, N. Y. App. filed Feb. 11, 1925. As used on telegraph lines.

1,559,858. INDUCTANCE DEVICE; F. E. Field, Somerville, N. J. App. filed July 25, 1923. To reduce capacity unbalance effects.

1,559,864. FILTERING CIRCUIT; T. C. Fry, Wyoming, N. J. App. filed Sept. 27, 1919.

1,559,865. SELECTIVE SIGNALING CIRCUITS; M. R. Gowing, Mountain Lakes, N. J. App. filed July 9, 1921.

1,559,867. WAVE-TRANSMISSION SYSTEM; E. V. Griggs, East Orange, N. J. App. filed Aug. 29, 1919.

1,559,869. SELECTIVE CURRENT PRODUCTION AND AMPLIFICATION; R. V. Hartley, East Orange, N. J. App. filed Sept. 23, 1919.

1,559,870. GENERATING AND MODULATING SYSTEM; R. A. Heising, East Orange, N. J. App. filed Feb. 7, 1920.

1,559,875. ELECTRODE FOR ARC WELDING; C. J. Holslag, South Orange, N. J. App. filed Dec. 13, 1919.

1,559,890. RENEWABLE ELECTRIC FUSE; F. C. LaMar, Pittsburgh, Pa. App. filed April 30, 1921.

1,559,901. METHOD OF REPAIRING CRACKED OR BROKEN STRUCTURES BY ELECTRIC WELDING; R. Mattice, Bethlehem, Pa. App. filed Oct. 3, 1924.

1,559,920. VARIABLE-SPEED INDUCTION MOTOR; R. E. Stewart, Los Angeles, Cal. App. filed Oct. 14, 1920.

1,559,945. POWER-TRANSMISSION MECHANISM; J. B. Entz, New Rochelle, N. Y. App. filed April 21, 1923. Particularly adapted to the propulsion of vehicles using internal-combustion engines.

1,559,955. ELECTRIC BURGLAR DETECTOR; N. L. Glover and J. A. Hanson, Windom, Minn. App. filed Feb. 11, 1924.

1,559,992. ARRANGEMENT FOR FREQUENCY TRANSFORMATION PARTICULARLY; W. Schaffer, Berlin, Germany. App. filed Aug. 18, 1922.

1,560,022. TRANSFORMER DIMMING METHOD AND APPARATUS; H. C. Dean, Brooklyn, N. Y. App. filed Jan. 6, 1922.

1,560,032. METHOD OF FORMING METAL REFLECTORS AND APPARATUS THEREFOR; B. Bart, East Orange, N. J. App. filed Sept. 23, 1921.

1,560,035. MOTOR-CASING CLOSURE; W. C. Brinton, New York, N. Y. App. filed Dec. 16, 1921.

1,560,054. MODULATED WAVE TRANSMISSION; R. A. Heising, East Orange, N. J. App. filed Sept. 21, 1915.

1,560,056. SOURCE OF WAVES OF CONSTANT FREQUENCY; J. W. Horton, Bloomfield, N. J. App. filed May 1, 1923.

1,560,103. ELECTRIC DISCHARGE TUBE; M. Schmierer, Friedenau, near Berlin, Germany. App. filed Feb. 21, 1921.

Financial and Corporate

Utility Market Improves

Electric Investors, Inc., Improves Its Position Smartly—Lehigh Power Strong

WHILE irregularities appeared in the movement of stocks in general listed on the New York Stock Exchange, the trend of utilities during the week under review was distinctly toward better levels. Announcement of the increase in the Boston Federal Reserve Bank rate from 3½ to 4 per cent brought an avalanche of selling in industrial stocks, many of them falling five, ten and twenty-five points, and the volume of sales for the first time exceeded that recorded on that day in May, 1901, when Hill and Harriman came to grips for control of the Northern Pacific. It must be said, however, that the utility shares did not suffer in this decline so much as the industrials and that by the close of the week most of the substantial changes that occurred in prices were gains rather than losses.

Outstanding among the gainers were Electric Investors, Inc., of which rumors in Wall Street had it that a stock dividend was on the cards. While the report was not verified, the stock in the week improved its position by nine points. Lehigh Power Securities, by advancing eighteen points, was another conspicuous gainer in a market generally good. The more conspicuous advances of the week occurred in United Gas Improvement, which was up six points; American Gas & Electric, up four; American Power & Light, up five; Eastern Texas, up four; Engineers' Public Service, up two and three-quarters; General Gas & Electric, up two; Middle West Utilities, up four; Northern States Power, up eight, and Southern California Edison Company, up two.

Losses, on the other hand, were recorded by National Power & Light after the market had risen so sharply in the week before. American Light & Traction also lost.

Utility Holding Company to Reorganize

The Electric Railway Securities Company, which was organized early last year and acquired certain assets and assumed all the liabilities of the Commonwealth Power, Railway & Light Company, is to be reorganized by an exchange of stock into a new company to be known as the Utility Shares Corporation. One-half share of participating preferred stock, one share of common stock and one option to purchase common stock at $10 in the new company will be offered for each share of Electric Railway held. The new company has an authorized capital of 50,000 shares of first preferred, 200,000 shares of participating preferred and 500,000 shares of common. An offer has been made by Hodenpyl, Hardy & Company and others of 30,000 shares of Commonwealth Power Corporation common stock in exchange for 120,000 shares of common stock and a like number of options in the new company.

Company Reports

The following statements of earnings have been issued by electric light and power companies for the month of September:

Name of Company	Gross Earnings for September 1925	1924
Adirondack Power & Light*	$754,540	$642,147
Cities Service	1,231,069	1,054,200
Detroit Edison*	†3,592,817	†2,831,547
Fort Worth Power & Light	239,295	255,555
Kansas Gas & Electric	363,056	429,508
Nebraska Power	336,182	311,216
Pacific Power & Light	315,875	273,413
Texas Power & Light	614,741	558,769
Utah Power & Light	842,111	799,460

* October. † Includes other revenue.

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Associated Gas & Electric, $6 pf.*	$1 50	Dec. 1
Blackstone Valley Gas & Elec., com.	$1.25	Dec. 1
Blackstone Valley Gas & Elec., pf.	3	Dec. 1
Cent. Miss. Valley Elec. Prop., pf.	1¾	Dec. 1
Laclede Gas & Electric., pr. In	1¾	Dec. 1
Laclede Gas Light, com	2	Dec. 15
Laclede Gas Light, com. (extra)	2	Dec. 15
Laclede Gas Light, pf.	2¼	Dec. 15
Los Angeles Gas & Electric, pf.	1½	Nov. 16
Middle West Utilities, pr. In	1½	Dec. 15
Northern States Power of Wis., pf.	1¾	Dec. 1
Ohio Brass (extra)	$1	Dec. 1
Philadelphia Electric	.50	Dec. 15
Southern Colorado Power, pf	1¾	Dec. 15
Standard Gas & Elec., 8% cum. pf	2	Dec. 15

* Payable in cash or class A stock at the rate of five-hundredths of a share for each share of preferred held.

Standard Gas & Electric Not Offering New Class A Stock to Shareholders.—J. H. Briggs, vice-president H. M. Byllesby & Company and Standard Gas & Electric Company, says that there is no truth in the report published last week in the New York newspapers that Standard Gas & Electric Company is offering new class A stock to its shareholders.

Havana Utility Stockholders Agree to Capital Readjustment.—More than 80 per cent of the preferred stockholders of the Havana Electric Railway, Light & Power Company and more than 90 per cent of the common stockholders have approved the readjustment in capital set-up outlined in the October 24 issue of the ELECTRICAL WORLD. In view of the response it is expected that the plan will be declared operative December 15. The time for deposit will be extended to that date.

New Capital Issues

An eight-million-dollar offering in the form of 6 per cent gold debentures, series A, was made by the American Water Works & Electric Company last Wednesday, the price being 94½ and accrued interest, to yield over 6.35 per cent. The proceeds from the sale of these gold debentures will be used to reimburse the company for expenditures in connection with the acquisition of additional properties, for additional working capital and for general corporate purposes. These bonds were eight times oversubscribed.

Also represented in the week's financing was the Southern Ohio Electric Company, which had an issue of first mortgage gold bonds amounting to $2,000,000 and priced at 100. An issue of Feather River Power Company first closed mortgage 6 per cent serial gold bonds, totaling $5,500,000, was made. The company's output is to be taken, under a thirty-five-year purchase contract, by the Great Western Power Company of California. The Georgia Railway & Power Company issued 7 per cent cumulative first preferred stock to the amount of $4,000,000, the price being par flat, to yield 7 per cent.

Other recent offerings were made by the Kaministiquia (Ontario) Power Company, Ltd., in the form of first mortgage 5½ per cent sinking-fund gold bonds, totaling $2,026,500 and priced at 99 and interest to yield about 5.57 per cent, and by the Northern Canada Power, Ltd., in the form of 6 per cent twenty-year sinking-fund gold bonds, totaling $6,000,000.

New Holding Company Elects Directors. — The following have been elected members of the board of directors of the Engineers' Public Service Company: Homer L. Ferguson, president Newport News Shipbuilding & Dry Dock Company; Andrew Fletcher, president American Locomotive Company; Eppa Hunton, Jr., president Richmond, Fredericksburg & Potomac Railroad Company; C. W. Kellogg of Stone & Webster, Inc., and Arthur W. Page, vice-president Doubleday, Page & Company. In addition to the foregoing the following are directors: Murray W. Dodge, Chase Securities Corporation; George M. Lindsay, Blair & Company, Inc.; Ray Morris, Brown Brothers & Company; Bayard F. Pope, Blodget & Company; Charles A. Stone, Stone & Webster, Inc., and Edwin S. Webster, Stone & Webster, Inc.

Listings.—The New York Stock Exchange has authorized the listing of the following securities: American Water Works & Electric, $550,000 additional common stock, par $20 each, on official notice of issuance as a 5 per cent stock dividend payable to common stockhold-

ers of record September 15, making the total amount applied for $11,550,000; Federal Light & Traction, $58,422 common stock (par $15 each) on official notice of issuance as a stock dividend of 15 cents per share, making the total amount applied for $5,900,641; North American Company, $785,600 additional common stock, par $10 each, on official notice of issuance as a 2½ per cent stock dividend, making the total amount applied for $32,266,850; Standard Gas & Electric, 126,484 shares common stock, without par value, upon official notice of issuance, making the total amount applied for not to exceed 775,567 shares of common stock without par value; West Penn Company, certificates of deposit for $17,456,200 of 7 per cent cumulative preferred stock (par $100) and 59,258 shares of common stock without par value of the West Penn Company on official notice of issuance of certificates.

National Power & Light Revamps Set-up

Shares of Old Utility Are Split—Carolina Power & Light Is Taken Into National Group—Consolidated Unit Has $31,000,000 Gross Earnings

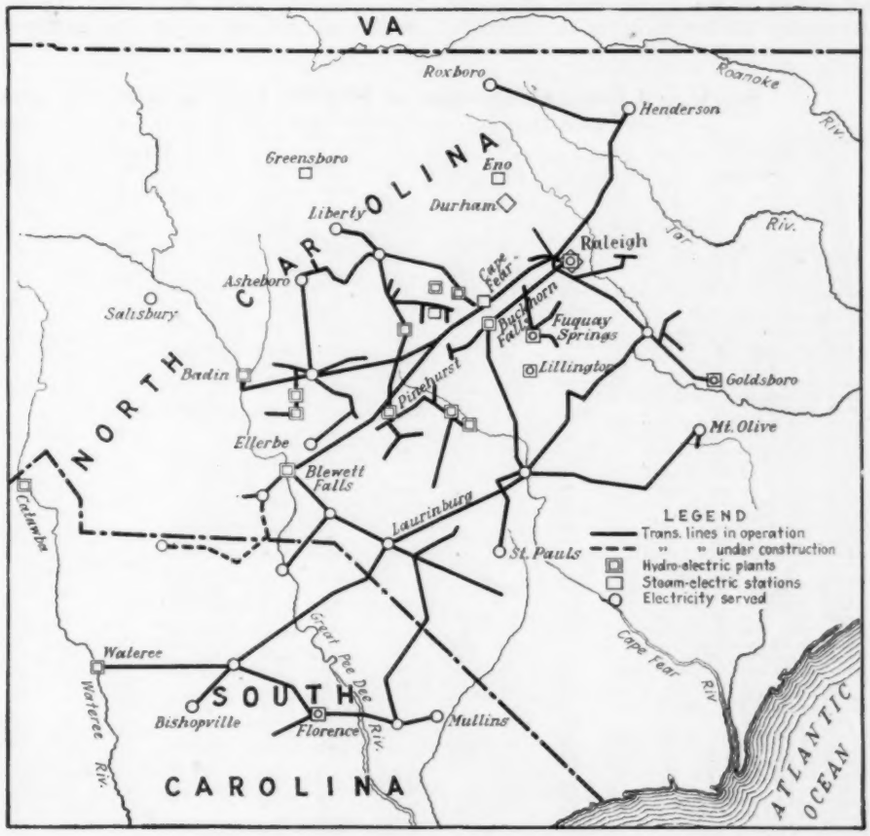
BY PAUL WILLARD GARRETT

WITHIN the last fortnight the National Power & Light Company, one of the more important utilities associated in the Electric Bond & Share group, has announced plans of an interesting character to revamp its capital set-up. The proposal involves (1) a consolidation of the old company with the United Investors' Securities Company, the consolidated company still to be called National Power & Light; (2) acquisition by the United Investors' Securities Company of the Carolina Power & Light Company through an exchange of stock, and (3) a split-up of National Power & Light shares on the basis of fifteen to one.

The Electric Bond & Share people feel that the interests both of the stockholders and customers will be better served through a unification of the two groups of properties formerly controlled by the National Power & Light and the Carolina Power & Light. How important these properties are may be judged by a few statistics compiled as of June 30, 1925, as follows: Gross earnings of National Power & Light Company and its subsidiaries for the twelve months ended on that date were $24,430,489 and of the Carolina Power & Light Company and its subsidiaries $6,291,753, making a total for the consolidated group of $30,722,242. Net earnings for the same period totaled $9,068,506 in the case of National and $2,664,178 in the case of Carolina, making an aggregate of $11,732,684. Unification of these two substantial groups creates a utility that will serve 1,196,000 people.

The National Power & Light Company's principal operating subsidiaries are the Arkansas Central Power Company, Birmingham Electric Company, Houston Lighting & Power Company, Memphis Power & Light Company, Knoxville Power & Light Company and the Jackson Railway & Light Company. The subsidiaries supply service to fifty-two communities in Tennessee, Alabama, Arkansas and Texas. The Carolina Power & Light Company, which may soon become a part of the system, operates the entire electric power and light, street railway and gas service in Raleigh, the gas service in Durham and the electric power and light service in Goldsboro, Henderson, Oxford, Sanford, Dunn and forty-five other communities, not to mention twenty-one other communities in which it sells at wholesale.

The National Power & Light Company, under the plan proposed, will not itself acquire the common stock of the Carolina Power & Light, but will consolidate with the United Investors' Securities Company. Carolina stockholders, under this arrangement, will exchange their holdings for stock in the United Investors' Securities Company on a share-for-share basis. It is doubtless reasoned that the valuable equities of the Carolina stockholders can better be preserved in the consolidation by making the exchange in this manner than by taking Carolina directly into National. It is provided that the United Investors' Securities Company will have no other stock outstanding than that issued in exchange for Carolina. The division of National Power & Light into smaller units is, of course, in keeping with the general policies of the Electric Bond & Share Company to bring the market price of utility stocks within reach of investors of moderate means. At $450 a share the old National Power & Light stock had become a rich man's stock. E. P. Summerson, president of the National Power & Light Company, says: "The future development of the two properties as one group will result in a greater degree of diversification and stability and thereby benefit the stockholders of both companies as well as the communities served."



TRANSMISSION SYSTEM OF CAROLINA POWER & LIGHT COMPANY AND AFFILIATED COMPANIES

New Company to Buy Stock.—The Eastern States Power Corporation, recently organized by the Carlisle and Schoellkopf interests, will acquire a large interest in the common stock of a company which will control the New England Power System. As announced previously in the ELECTRICAL WORLD, the Power Corporation of New York, Stone & Webster, Inc., and associates, the International Paper Company and interests previously identified with the New England Power System, will also acquire substantial amounts of the common stock of this new company.

Ingersoll-Rand Net Income $2,715,970.—For the six months ended June 30, 1925, the Ingersoll-Rand Company reports net income of $2,715,970 after depreciation, interest and federal taxes, equivalent after preferred dividends to $10.98 a share ($100 par) on the 240,563 common shares outstanding. Con-

solidated balance sheet as of June 30 shows current assets of $26,162,166 and current liabilities of $2,008,189, leaving net working capital of $24,153,977.

Australia Company Calls Bonds.—The Melbourne (Australia) Electric Supply Company, Ltd., has called for redemption December 1 at 102½ and interest 7½ per cent general mortgage sinking-fund gold bonds, due 1946, aggregating $26,500.

Weston Instrument Makes Quarterly Report.—The Weston Electrical Instrument Corporation reports for the September quarter net income of $171,169 after interest and federal taxes, equal to 98 cents a share on the 100,000 no-par class A shares and to 73 cents on the 100,000 common shares. This compares with $177,048, or $1.02 a share, earned on the class A and 76 cents on the common in the preceding quarter. Net income for nine months totaled $513,282.

General Gas & Electric Offers Stockholders Subscription Rights.—The General Gas & Electric Corporation has offered to all its stockholders of record November 20 the right to subscribe to class A common stock at $45 a share on the basis of one share for each ten shares of any class of stock held. Subscription privilege expires December 10, and stock issued will carry dividend payable January 2, 1926. The corporation will also offer to the holders of its common stock, class A, who shall be entitled to the dividend payable January 2 the right to subscribe to additional shares of this stock to the extent of the dividends to which they are entitled at $25 a share. Proceeds from the sale of the additional class A stock will be applied toward property acquisitions and extensions and improvements to service.

North American Edison Increases Capital.—The capital stock of the North American Edison Company, a subsidiary of the North American Company, has been increased from 400,000 shares to 1,000,000 shares (no par value), consisting of 500,000 shares of preferred and 500,000 shares of common stock.

Philadelphia Electric to Issue Stock.—Directors of the Philadelphia Electric Company have authorized the issuance of 585,360 shares of common stock for cash at par of $25 a share. Privilege of subscription will be given to holders of common stock to the amount of 22½ per cent of their holdings as of November 17. The proceeds will be used for corporate needs.

Purchase of Siemens Shares by the Prussian State.—According to official information, the majority of the stock of the Siemens Elektrische Betriebe A. G., an electric power company at Hamburg, has been purchased by the Prussian State from the Swiss Association for Electrieal Industry at Glarus, Switzerland, and the Siemens-Schuckert group. The interest of the state in these shares is in the first place an electro-economic one and aims at gaining influence in the vast district governed by the Siemens Elektrische Betriebe A. G. and reaching from the Dutch boundary to Wismar, just north of an area in which the state influence is predominant and which is supplied with current by the Grosskraftwerk Hannover A. G. Viewed from a merely economic point of view, this purchase can be considered as highly profitable as the interconnection of transmission lines will guarantee a better use of power stations in the two districts.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Nov. 14	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	f68½	62	75½
Adirondack Pwr. & Lt.—7% pf.	101	98	106
Adirondack Pwr. & Lt.—8% pf.	105	103	115
Adirondack Pwr. & Lt., com.—50	75	31	98
Ala. Pwr., pf.	104	97½	103
Allis-Chalmers Mfg. pf.	f108	103½	108¾
Allis-Chalmers Mfg., com.	f 89½	71½	95
Amer. & Foreign Pwr., pf. 25% pd.	k132½	131	142
Amer. & Foreign Pwr., 7% pf.	93	87	94
Amer. & Foreign Pwr., com.	f 41½	27½	51½
Amer Bosch Magneto, com.—no par	f 30½	26½	54¼
Amer. Brown, Boveri, ptc., stk.	f 50	49½	53¾
Amer. Elec. Pwr., pf.	c 100½	91½	104½
Amer. Gas & Elec., 6% pf.—no par	91	85	91
Amer. Gas & Elec., com.—no par	80	70	85
Amer. Lt. & Trac., 6% pf.	110	93	115
Amer. Lt. & Trac., com.	263	139	288
Amer. Pwr. & Lt., 6% pf.	94	84	95
Amer. Pwr. & Lt., com.—no par	65	52	67½
Amer. Pub. Serv., 7% pf.	90	88	94
Amer. Pub. Serv., com.	47	45	90
Amer. Pub. Utilities, 4% pf.	80	....	....
Amer. Pub. Utilities, 6% pf.	79	71	82
Amer. Pub. Utilities, 7% pf.	87	87	95
Amer. Pub. Utilities, com.	78	70	103
Amer. Superpwr., pf.—25	f 25½	....	....
Amer. Superpwr., Class A—no par.	f 35	....	....
Amer. Superpwr., Class B—no par.	f37	....	....
Amer. Wtr. Wks. & Elec., 7% pf.	f100½	98	103
Amer. Wtr. Wks. & Elec., com.	f55	34¼	68½
Appalachian Pwr., 7% pf.	101	92	100
Appalachian Pwr., 1st pf., 7%	101	95	101
Appalachian Pwr., com.—no par	78	70	83
Arizona Pwr., 7% pf.	83	75	87
Arizona Pwr., com.	33	15	34¾
Arkansas Cent. Pwr., pf., $7—no par	100	97	102
Arkansas Lt. & Pwr., 7% pf.	97	92	102
Arkansas Lt. & Pwr., com.	100	65	101
Asheville Pwr. & Lt., 7% pf.	j103	98	103
Assoc. Gas & Elec., 7% pf.—1% extra—50	f 50½	....	....
Assoc. Gas & Elec., pf.—$6—no par	f 82	....	....
Assoc. Gas & Elec., Class A	f 35½	....	....
Babcock & Wilcox, com.	f144	....	....
Birmingham Elec. pf.—$7—no par.	101	98	101½
Blackstone Valley Gas & Elec., com.—50	93	....	....
Brazilian Trac., Lt. & Pwr., com.	j 76	....	....
Broad River Pwr., pf.	94	90	97
Brooklyn Edison, com.	f139½	120½	156½
Buffalo Gen. Elec., com.—no par.	k58	50	77
Buffalo, Niagara & East. Pwr., pf.—25.	j23½	....	....
Buffalo, Niagara & Eastern Pwr., com.	j31½	....	....
Carolina Pwr. & Lt., pf.—$7—no par	104½	100	107
Carolina Pwr. & Lt., com.	440	290	456½
Central Ariz. Lt. & Pwr., pf.	100	100	106
Central Ark. Ry. & Lt., 7% pf.	96	91	98½
Central Ill. Pub. Serv., 6% pf.	86	84	93
Central Ind. Pwr., 7% pf.	87	88	95
Central Pwr. & Lt., pf.	93	88	95
Central States Elec., 7% pf.	94	87	98
Central States Elec., com.	220	70	225
Century Elec., com.	k103	103	110
Chicago Fuse Mfg., com., no par	a32½	27½	39½
Cincinnati Gas & Elec., com.	g89½	82	90½
Cities Service, 6% pf.	83½	80	84
Cities Service, pf. B—10	f 7½	....	....
Cities Service, pf. BB—100	f 78½	....	....
Cities Service, com.—20	38½	34	43
Cities Service, Bks. Shrs.—10	17½	16½	22
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com.	240	200	250
Colorado Pwr., 7% pf.	96	93	98
Columbia Gas & Elec., 7% pf.	112	104½	113½
Columbia Gas & Elec., com.—no par	f 80½	45½	86
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	f100	....	....
Columbus Elec. & Pwr., com.	f147	....	....
Columbus Ry., Pwr. & Lt., pf. A	97	86	99
Columbus Ry., Pwr. & Lt., pf. B	92	80	85
Columbus Ry., Pwr., & Lt., com.	150	114	150
Commonwealth Edison, com.	a138	130½	141½
Commonwealth Pwr., 6% pf.	84½	80	85½
Commonwealth Pwr., com—no par.	33	30½	43½
Conn. Lt. & Pwr., 8% pf.	118	115	118
Conn. Lt. & Pwr., 7% pf.	111	105	110
Cons. Gas of N. Y., pf.	f 57½	....	....
Cons. Gas of N. Y., com—no par	f 93½	74½	95½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	c104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	c108	105	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	c111	109	114
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c124½	122	127½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	c 44	32	47½
Cons. Utilities of Dela., 7% pf.	k 85	80	84
Consumers Pwr., 6% pf.	96	90	97
Consumers Pwr., 6 6% pf.	101½	97	102
Continental Gas & Elec., 7% ptc. pf	95½	85	97
Continental Gas & Elec., 7% pr. pf.	96	89	95
Continental Gas & Elec., com—no par	140	77	145
Crocker Wheeler, com.	15	21	28
Crocker Wheeler, pf.	..	65	80
Dallas Pwr. & Lt., 7% pf.	101	100	102½
Dayton Pwr. & Lt., 6% pf.	95½	88	100
Dayton Pwr. & Lt., com.	420	180	460
Detroit Edison, com.	f139	110	159½
Dubilier Condenser & Radio, com.	f 11½	....	....
Dubuque Elec., 7% pf.	90	80	90
Duquesne Lt., 7% pf.	111	104	112
East. Tex. Elec., 6% pf.	100	100	105
East. Tex. Elec., com.—no par.	80	70	75½
Edison Elec. Illum. of Boston, com.	d209½	200	213
El Paso Elec., com.	f 74	....	....
El Paso Elec., pf.	f100	....	....
Elec. Bond & Share, 6% pf.	j104	101½	106½
Elec. Bond & Share Sec., com.—no par	j67½	56½	80½
Elec. Investors, 6% pf—no par.	92	95	96
Elec. Investors, com.—no par.	68	30	69½
Elec. Investors, 10% pd. receipts.	49½	15	50
Elec. Pwr. & Lt., ctfs. pf.	f 92	89½	94
Elec. Pwr. & Lt., ctfs., 40% pd.	f106½	100	110
Elec. Pwr. & Lt., ctfs. full pd.	106	100½	110½
Elec. Pwr. & Lt., ctfs., com.	f 31	17½	40½
Elec. Storage Battery, com.—no par	f 74½	60½	77
Elmira Wtr., Lt. & R.R., 7% pf.	96½	93	98
Emerson Elec., pf.	b100½	95	101½
Empire Dist. Elec., 6% pf.	80	78	85
Engr. Pub. Serv., pf.—no par.	99	100	103
Engr. Pub. Serv., com.—no par.	24	19½	30
Eureka Vacuum Cleaner, com.—no par.	f 50½	50	55½
Fairbanks Morse, com.	f 50½	32½	54½
Federal Lt. & Trac., com.	f 27½	26	36
Federal Light & Traction, pf.	k 83½	82½	86½
Federal Utilities, pf.	f 75	....	....
Federal Utilities, com.	f 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	j105½	99½	107½
Galveston-Houston Elec., 6% pf.	64	70	75
Galveston-Houston Elec., com.—no par.	25	20	40
Gen. Elec., com.	f318½	227½	337½
Gen. Elec., special—10	f 11½	10½	11½
Gen. Gas & Elec., 6% pf.—no par.	220	72	240
Gen. Gas & Elec., 7% pf.	165	120	175
Gen. Gas & Elec., com.—no par.	210	72	240
Gen. Gas & Elec., (Me.) pf.—$7—no par	130	90	175
Gen. Gas & Elec., (Me.) pf.—$8—no par.	140	104½	180
Gen. Gas & Elec. (Del.) com. A	61	42	64½
Gen. Gas & Elec. (Del.) com. B no par.	56	40	62
Gen. Gas & Elec. (Del.) A pf. 7% no par.	95	97½	100
Gen. Gas & Elec. (Del.) A pf. 8% no par.	107	90	110
Gen. Gas & Elec. (Del.) B pf. 7% no par.	94	88	96
Ga. Lt., Pwr., & Rys., 6% pf.	77	74	85
Ga. Lt., Pwr. & Rys., com.	60	25	74
Ga. Ry. & Elec. .5% pf.	k 83	78½	84½
Ga. Ry. & Elec. ,com.	k124½	115½	115½
Ga. Ry. & Pwr., 8% pf.	f112	....	....
Ga. Ry. & Pwr. ,7% pf.	f101½	....	....
Ga. Ry. & Pwr., 4% pf.	133	62	110
Ga. Ry. & Pwr., com.	137	62	140
Gt. Western Pwr., 7% pf.	j101½	....	....
Havana Elec. Ry., Lt. & Pwr., com.	k236	112	246
Havana Elec. Ry., Lt. & Pwr., pf.	k112	112	116
Hurley Machine, com.—no par.	a 50	41½	56
Idaho Pwr., 7% pf.	100½	97½	102
Ill. No. Utilities, 6% pf.	88	82	92
Ill. Pwr. & Lt., 7% pf.	96½	92½	98
Int. Combustion Engr., com.—no par.	f 54½	31½	58½
Int. Utilities, class A—no par.	f 36½	....	....
Int. Utilities, class B—no par.	f 8½	....	....
Interstate Pwr., pf., $7, no par.	90	90	95
Interstate Pub. Serv., 7% pf.	96	90	100
Iowa Ry. & Lt., 7% pf.	97	92	100
Jersey Central Pwr. & Lt., 7% pf.	95	90	96
Jersey Central Pwr. & Lt., com.—no par.	45	15	50
Johns-Manville, com.—no par.	f149½	....	....
Kansas Gas & Elec., 7% pf.	j102	97½	102
Kelvinator Corp., com.—no par.	f 81	....	....
Kentucky Hydro-Elec., com.	k 91½	85½	92½
Kentucky Sec., 6% pf.	73	67	78
Kentucky Sec., com.	82	77	87
Kentucky Utilities, 6% pf.	88	82	95
Kings County Ltg., 7% pf.	f100	....	....
Laclede Gas Lt., com.	f164	110½	178
Lehigh Pwr. Sec., cap.—no par.	f185	82	188

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. fBid, low, high, Tuesday, Nov. 17. jBid, low, high Wednesday, Nov. 18. kLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Nov. 14	Low 1925	High 1925
STOCKS—Continued			
Long Island Ltg., 7% pf.	104½	100	105
Long Island Ltg., com—no par.	135	60	142
Los Angeles Gas & Elec., 6% pf.	95	90	98
Manila Elec., com.—no par	f 38	28½	49½
Maytag Mfg., com.	f 23½	22	26¼
Memphis Pwr. & Lt., pf., $7, no par.	102½	98½	102
Metropolitan Edison, pf.—$6—no par	92½	92	96
Metropolitan Edison, pf., $7, no par.	104	100	110
Middle West Utilities, 7% pf.	a 97	91½	98½
Middle West Utilities, 7% pr. lien pf.	a106½	98	107½
Middle West Utilities, com.—no par	a116	92½	125
Midland Utilities, pr. ln. pf.	a 99½	98½	101
Milwaukee Elec. Ry. & Lt., 8% pf.	100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	97	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	86½	83½	87
Minn. Pwr. & Lt., 7% pf.	f101	97½	102
Miss. Pwr. & Lt., pf.	f100	....	....
Miss. River Pwr., 6% pf.	f 94	87½	94
Miss. River Pwr., com.	108	37	124½
Montana Pwr., pf.	f112½	109	117
Montana Pwr., com.	f 81½	64	99½
Montreal Pwr., com.	k 212½	....	....
Mountain States Pwr., pf.	f 94	....	....
Mountain States Pwr., com.	f 27	....	....
National Carbon, com.	k124	120	130
National Carbon, pf.	104½	....	....
National Elec. Pwr., pf.	a 94½	94	96½
National Lt., Ht. & Pwr., 5% pf.	71	40	72
National Lt., Ht. & Pwr., com.—no par	24	11	30
National Pwr. & Lt., pf., $7—no par	101	95	99
National Pwr. & Lt., com.—no par.	443	185	464
National Pub. Serv., 7% pf.	f 93	....	....
National Pub. Serv., pfc. pf.	f 98	....	....
National Pub. Serv., A com.—no par	f 23	....	....
National Pub. Serv., B com.—no par	f 14½	....	....
Nebraska Pwr., 7% pf.	f102½	98½	103½
Nevada-Calif. Elec., com.	42	31	58
N. J. Pwr. & Lt., 7% pf.	103	92	102
New Orl. ans Pub. Serv., 7% pf.	100	94	102
New Orleans Pub. Serv., com.—no par	k 30	31	38½
N. Y. Central Elec., 7% pf.	97	96	101
Niagara Falls Pwr., 7% pf.—25	28	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	k106	101½	110
Niagara, Lock. & Ont. Pwr., com.—no par	k 63	60	73
Nizer Corp., A.—no par.	f 82	....	....
Nizer Corp., B.—no par.	f 82½	....	....
No. Amer., 6% pf.—50	f 49½	46½	50½
No. Amer., com.—50	f 66½	41½	75
No. Caro. Pub. Serv., pf.—$7—no par	90	90	96
No. N. Y. Utilities, 7% pf.	f101½	....	....
No. Ohio Pwr., com.—no par.	15	5	19
No. Ohio Trac. & Lt., 6% pf.	73	64	75
No. Ont. Lt. & Pwr., pf.	76	68	78
No. Ont. Lt. & Pwr., com.	46	41	52
No. States Pwr., 7% pf.	99½	95	100
No. States Pwr. com.	133	103	141
No. Texas Elec., 6% pf.	50	60	75
No. Texas Elec., com.	40	40	70
Ohio Gas & Elec., 7% pf.	90	87	100
Ohio Pwr., 6% pf.	93	85	95
Ohio Pub. Serv., 7% pf.	97½	97	100
Ohio River Edison, 7% pf.	97	93½	100½
Oklahoma Gas & Elec., pf.	f 93	....	....
Pacific Gas & Elec., 6% pf.	97	92	99
Pacific Gas & Elec., com.	129	102½	137½
Pacific Pwr. & Lt., 7% pf.	f100	97½	102
Parr Shoals Pwr., 6% pf.	92	90	100
Penn Central Lt. & Pwr., pf.—no par	k 70	60	71
Penn-Ohio Elec., 7% pf.	93	83½	96
Penn-Ohio Pwr. & Lt., 7% pf.	97	91	100
Penn-Ohio Pwr. & Lt., 8% pf.	102	101	110
Penn Pwr. & Lt.—$7—no par.	f105	98½	106½
Penn Pub. Serv., 7% pf.	96	90	100
Penn Pub. Serv., 6% pf.	85	80	90
Penn Wtr. & Pwr., com.	e162	126½	185
Phila. Co., pf.—50% (Pitts.)	c 48½	37½	49½
Phila. Co., com.	f 62½	51½	64½
Phila. Elec., com.	c 53½	37½	57½
Pittsburgh Utilities, pf.	f 15½	12½	17½
Portland Elec. Pwr., 7% pf.	98	95	99
Portland Elec. Pwr., 6% pf.	72	70	80
Portland Elec. Pwr., com.	44	40	53
Portland Ry., Lt. & Pwr., pf.	k 72	....	....
Portland Ry., Lt. & Pwr., com.	k 41	....	....
Pwr. Corp. of N. Y., 7% pf.	k110	96	112
Pwr. Corp. of N. Y., com.—no par	73	15	89½
Pwr. Sec., pf.—no par.	20	20	55
Pwr. Sec., com.—no par.	15	8	30
Pub. Serv. of N. J., 7% pf.	f105	99	105½
Pub. Serv. of N. J., 8% pf.	f117	109	119
Pub. Serv. of N. J., com—no par.	f 80½	62½	87½
Pub. Serv. of No. Ill., 6% pf.	a 98	92	100
Public Serv. of No. Ill., 7% pf.	a111	102	111
Pub. Serv. of No. Ill., com.—no par	a127	107½	128½
Pub. Serv. of No. Ill., com.	a127	118	128½
Pub. Serv. of Okla., 7% pf.	93	87	95
Pub. Serv. Elec. & Gas, 6% pf.	f 98½	92½	98½
Puget Sound Pwr. & Lt., 7% pf.	106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	f 84½	....	....
Puget Sound Pwr. & Lt., com.	48	49	61
Radio Corp. of Amer., pf.—50	46	45½	54
Radio Corp. of Amer., com.—no par	f 48½	45½	77½
Republic Ry & Lt., pf.	85	70	85
Republic Ry. & Lt., com.	62	49	65
Rochester Gas & Elec., 5% pf.	95	80	98
Servel Corp., Class A.	f 32½	....	....
Servel Corp., Class B—no par	56	35	62½
Sierra Pacific Elec., com.	f 25	....	....
Sioux City Gas & Elec., 7% pf.	f 99	....	....
Southeastern Pwr. & Lt., 7% pf.—no par	97	90	100
Southeastern Pwr. & Lt., com—no par	31½	28	34½
So. Calif. Edison, 8% pf.	135	115	128
So. Calif. Edison, 7% pf.	110½	105	107½
So. Calif. Edison, 6% pf.	97½	90	95½
So. Calif. Edison, com.	133	102	149
Southern Cities Utilities, 7% pf.	82	77	100
Southern Cities Utilities, com.	50	30	71
Southern Pwr. & Lt. of Md., pf.	f107	....	....
Southern Pwr. & Lt. of Md., com.	f 32	....	....
Southwestern Pwr. & Lt., A.	f 47	....	....
Southwestern Pwr. & Lt., B.	f 22½	....	....
Southwestern Pwr. & Lt., 7% pf.	99½	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	96	92	93
Standard Gas & Elec., 8% pf.	f 55½	50½	56½
Standard Gas & Elec., 7% pf.	100½	96	100
Standard Gas & Elec., com.—no par	f 57½	40½	61
Standard Pwr. & Lt., 7% pf.	108	95	114½
Superheater, com.—No par.	142	120	152
Tampa Elec., com.	f272	....	....
Tenn. Elec. Pwr., 6% pf.	85	80	85
Tenn. Elec. Pwr., 7% pf.	98	93	103
Tenn. Elec. Pwr., pf.—$6—no par.	k 80	72	84
Tenn. Elec. Pwr., com.—no par.	k 65	....	....
Tex. Pwr. & Lt., 7% pf.	f104	99½	106
Tide Water Pwr., 8% pf.	f 98	....	....
Timken Roller Bearing, com.	f 55½	37½	59½
Toledo Edison, 8% pf.	112	109	114
Toledo Edison, 7% pf.	101	94	101½
Toledo Edison, com.	25	21	25
Tri-City Ry. & Lt., 6% pf.	85	82	85
United Gas & Elec., 6% pf.	92	80	94
United Gas & Elec., com.—no par.	55	26	56
United Gas & Elec. (N. J.), 5% pf.	62	55	65
United Gas Impr.—50	c(116½	79½	120½
United Lt. & Pwr., pf.—$4—no par	50	41	51
United Lt. & Pwr., pf.—$6.50—no par.	92½	83	99
United Lt. & Pwr., com., A—no par.	151	42	166½
United Lt. & Pwr., com., B—no par.	160	49	100
Utah Pwr. & Lt., 7% pf.	f 99	97½	101½
Utica Gas & Elec., 7% pf.	103	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	90	90	97
Utilities Pwr. & Lt., com. B—no par	18	12	22
Vermont Hydro-Elec., 7% pf.	92	87	96
Virginia Pwr., 7% pf.	101	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	f149	64½	150
Wagner Elec., pf.	b 87	79	92
Wagner Elec., com.—no par	b 40	26½	50
Washington Wtr. Pwr., com.	129	110	140
West Mo. Pwr., 7% pf.	f 91	....	....
West Penn., 7% pf.	f 96½	94	100
West Penn, com.	f113	97	145
West Penn Pwr., pf.	k108½	104	111
West Virginia Lt., Ht. & Pwr., 7% pf.	94	94½	96½
West Va. Utilities, 7% pf.—50	41	38	47
Western Elec., 7% pf.	k 83	110	117½
Western Pwr., 7% pf.	97	84	....
Western Pwr., com.—no par.	80	34	102
Western States Gas & Elec., 7% pf.	88	82	92
Western States Gas & Elec., com.	f 19	....	....
Westinghouse Elec. & Mfg., com.—50	f 74	66½	84
Weston Elec. Instrument, Cl. A.	f28½	19½	28½
Weston Elec. Instrument, com.	f 17½	9½	20½
Wis.-Minn. Lt. & Pwr., 7% pf.	k 90	92	95
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	76½	76	88
Worthington Pump, pf. B	f 64	58	76½
Worthington Pump, com.	f 40½	35½	79½
Yadkin River Pwr., 7% pf.	f104½	98	106
Yale & Towne, com.—25	f 64	62	70½
BONDS			
Abitibi Pwr. & Paper	6s 1940	100½	98	101½
Adir. Elec. Pwr.	5s 1962	99½	97½	100½
Adir. Pwr. & Lt.	6s 1950	104½	102½	105½
Adir. Pwr. & Lt.	5s 1930	97	94	98
Ala. Pwr.	5s 1946	98½	96	100
Ala. Pwr.	5s 1951	95½	92½	97½
Ala. Pwr.	6s 1951	104½	101½	105
Ala. Trac. Lt. & Pwr.	5s 1962	107	86	105
Aluminum Co. of Amer.	7s 1933	106½	106½	107½
Amer. Bosch Magneto	8s 1936	k103	86	101
Amer. Gas & Elec.	5s 2007	91	90	93½
Amer. Gas & Elec.	6s 2014	98	96½	98½
Amer. Pwr. & Lt.	6s 2016	96½	94	98
Amer. Pub. Serv.	6s 1942	98	94	99½
Amer. Wtr. Wks. & Elec.	5s 1934	95½	92½	98
Anaconda Copper	6s 1929	102½	102½	104
Anaconda Copper	6s 1953	101½	99½	102
Anaconda Copper	7s 1938	105½	99½	105½
Appalachian Pwr.	5s 1941	98	96	99½
Appalachian Pwr.	6s 2024	93½	86½	94½
Appalachian Pwr.	7s 1936	105	105½	106½
Arizona Pwr.	6s 1933	100	97½	101½
Arizona Pwr.	6s 1947	95½	90	96
Ark. Central Pwr.	6s 1948	100½	98½	102½
Ark. Lt. & Pwr.	6s 1945	102½	100	104½
Ark. Lt. & Pwr.	6s 1954	98½	92½	99½
Assoc. Gas & Elec.	6s 1965	93½	92	96
Assoc. Gas & Elec.	6½ 1954	100	94½	106
Binghamton Lt., Ht. & Pwr.	5s 1946	98½	94½	99
Birmingham Elec.	6s 1954	101½	99	103
Birmingham Ry., Lt. & Pwr.	4½s 1954	87½	85	89½
Broad River Pwr.	6½s 1934	100	99	102
Brooklyn Edison	5s 1949	102	99½	103
Brooklyn Edison	6s 1930	105	103½	106
Buffalo Gen. Elec. 1st	5s 1939	101½	100½	101½
Buffalo Gen. Elec. 1st & Ref.	5s 1939	101	100	100½
Burlington Ry. & Lt.	5s 1932	94½	90	96
Butte Elec. & Pwr.	5s 1951	99½	99	100½
Calif. Gas & Elec.	5s 1937	100½	98	101½
Canadian Lt. & Pwr.	5s 1949	40	36	62
Canton Elec.	5s 1937	99½	99	100½
Carolina Pwr. & Lt.	5s 1938	99½	98½	100½
Carolina Pwr. & Lt.	6s 1953	104½	103½	105
Cedar Rapids Mfg. & Pwr.	5s 1953	99½	98½	100½
Central Ark. Ry. & Lt.	5s 1928	98½	98½	100
Central Ga. Pwr.	5s 1938	95½	93	97
Centralill. Lt.	5s 1943	98½	94	99½
Centralill. Publ Serv.	5s 1952	89½	84½	92½
Centralill. Pub. Serv.	5½s 1950	96	96½	98
Centralill. Pub. Serv.	6s 1944	99½	96½	101½
Central Ind. Pwr.	6s 1947	98½	95½	99½
Central Ia. Pwr. & Lt.	6s 1944	99	97	100½
Central N. Y. Gas & El.	5s 1941	95	94	97½
Central Pwr. & Lt.	6s 1946	100½	97½	101½
Central Pwr. & Lt.	6½s 1952	101½	94	102
Central States Elec.	5s 1926	k 99	98	100½
Chattanooga Ry. & Lt.	5s 1956	84	81	85
Cincinnati Gas & Elec.	5s 1956	101½	98½	104½
Cincinnati Gas & Elec.	5½s 1967	103½	100½	105½
Cities Service	6s 1966	90½	90	91½
Cities Service	7s B 1966	178	150½	178½
Cities Service	7s C 1966	126	111	128
Cities Service	7s D 1966	101½	98½	106½
Cities Service	7s E 1966	111½	111	112½
Cities Service Pwr. & Lt.	6s 1944	93½	93½	95
City Lt. & Trac., Sedalia, Mo.	5s 1952	84	74	85½
Cleveland Elec. Illum.	5s 1939	101½	100	102
Cleveland Elec. Illum.	5s 1954	100½	97½	101
Cleveland Elec. Illum.	7s 1941	110	109	111½
Colorado Pwr.	5s 1953	95½	93	96½
Columbia Gas & Elec.	5s 1927	99½	99½	100½
Columbia Ry., Gas & El.	5s 1936	92	92½	94½
Columbus, Dela. & Marion Elec.	5s 1937	85	83	88
Columbus, Dela. & Marion Elec.	6s 1937	95	91	98
Columbus Elec. & Pwr.	6s 1947	102	....	....
Columbus Ry., Pwr. & Lt.	5s 1940	95½	93½	98
Columbus Ry., Pwr. & Lt.	6s 1941	103	101½	105
Commonwealth Edison	5s 1943	102½	99½	102½
Commonwealth Edison	5s 1953	99½	98½	101
Commonwealth Edison	5s 1954	99½	98	101
Commonwealth Pwr.	6s 1947	103	97½	103½
Community Pwr. & Lt.	6s 1950	96	94	98
Conn. Ry. & Ltg.	4½s 1951	87	90½	92½
Consol. Cities, Lt., Pwr. & Trac.	5s 1962	80½	75½	82½
Consol. Elec.	5s 1955	97½	94	98½
Consol. Gas of N. Y.	5½s 1945	104½	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s 1935	c 97½	93½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s 1949	c105½	104½	106½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5½s 1952	104	101½	105½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s 1965	100	99	100½
Con. Gas, Elec. Lt. & Power of Baltimore	5½s 1952	104	102½	105½
Consumers Elec. Lt. & Pwr.	5s 1936	94	93	96½
Consumers Pwr.	5s 1936	100	99	100½
Consumers Pwr.	5s 1952	98½	90½	100
Consumers Pwr.	5½s 1954	103	99	104½
Continental Gas & Elec.	5s 1927	100	99½	100½
Continental Gas & Elec.	6s 1947	99½	98	101
Continental Gas & Elec.	6½s 1964	98	96½	101
Continental Gas & Elec.	7s 1954	104½	99	103½
Cumberland County Pwr. & Lt.	5s 1942	94½	92	96½
Dallas Pwr. & Lt.	6s 1949	104½	103	105½
Dayton Ltg.	5s 1937	99½	98½	100½
Dayton Pwr. & Lt.	5s 1941	99½	97	100½
Defiance Gas & Elec.	5s 1942	95	88½	97½
Denver Gas & Elec.	5s 1949	97½	97½	100
Denver Gas & Elec. Lt.	5s 1951	93	92	95½
Des Moines Elec.	5s 1938	98	98	100½
Detroit Edison	5s 1933	101½	99½	102½
Detroit Edison	5s 1940	102½	99½	102½
Detroit Edison	5s 1949	99½	97½	101½
Detroit Edison	5s 1955	k 99½	97½	100
Detroit Edison	6s 1932	140	110½	155
Detroit Edison	6s 1940	107½	106½	108½
Detroit Edison	7s 1928	k150½	125	156½
Detroit Edison	7s 1929	k150½	114	150½
Detroit Edison	7s 1930	140½	121½	158½
Dominion Pwr. & Trans.	5s 1932	95	95½	98½
Driver-Harris	8s 1931	95	88	97
Dubuque Elec.	6s 1942	101	97½	102
Duke-Price Pwr.	6s 1949	101	98½	103
Duquesne Lt.	6s 1949	105	104½	107½
Duquesne Lt.	5½s 1949	104½	104	106
Durham Pub. Serv.	7s 1949	100	97½	101½
East Penn. Elec.	6s 1953	104½	100½	105½
East Oregon Lt. & Pwr.	6s 1929	100	97½	100½
East. Tex. Elec.	5s 1942	f 95	....	....
Economy Lt. & Pwr.	5s 1956	98	98	99½
Edison Elec. Illum. of Bkln.	4s 1939	92½	89	95½
Edison Elec. Illum. (N. Y.)	5s 1995	102	99½	103
El Paso Elec.	5s 1932	f102	....	....
El Paso Elec.	5s 1950	f 95½	....	....
Elec. Pwr. Corp. (Germany)	6½s 1950	87½	86½	88½
Elmira Wtr., Lt. & R.R.	5s 1956	95	92½	96½
Empire Dist. Elec.	5s 1949	91	85	91½
Erie Ltg.	5s 1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s 1932	98½	96	100
Federal Lt. & Trac.	5s 1942	92½	88	101½
Federal Lt. & Trac.	6s 1942	100½	96½	103
Federal Lt. & Trac.	6s 1954	93½	91½	94½
Ft. Smith Lt. & Trac.	5s 1936	78½	76½	82½
Ft. Worth Pwr & Lt.	5s 1931	99½	99	100½
Galveston Elec.	5s 1940	91	86½	93½
General Elec.	3½s 1942	89	83	90½
General Elec.	5s 1952	k107½	101½	107½
Georgia Carolina Pwr.	5s 1952	85½	82	90
Ga. Lt., Pwr. & Rys.	5s 1941	88	86½	90½
Ga. Ry. & Elec.	5s 1932	98	98½	100½
Ga. Ry. & Elec.	5s 1949	92	88	94½
Ga. Ry. & Pwr.	5s 1954	93½	89½	94
Ga. Ry. & Pwr.	6s 1947	102	100½	103½
Ga. Ry. & Pwr.	7s 1941	104½	105	107
German Gen. Elec.	7s 1945	96	92	96½
Great Cons. Elec. Pwr. (Japan)	6½ 1950	86	86	86½
Great Cons. Elec. Pwr. (Japan)	7s 1944	90½	87½	91½
Great Falls Pwr.	5s 1940	102½	99½	102½
Great Northern Pwr.	5s 1935	98½	96	99
Great Western Pwr.	5s 1946	98½	95	99½
Great Western Pwr.	5½s 1955	98	96	99
Great Western Pwr.	6s 1949	100½	100	102½
Great Western Pwr.	6s 1952	101	99½	102½
Hamburg Elec.	7s 1935	96	95½	96
Havana Elec. Ry., Lt. & Pwr.	5s 1954	92½	85½	95½
Holtwood Pwr.	6s 1954	103½	90	104½
Houston Ltg. & Pwr.	5s 1931	99½	98½	100
Houston Ltg. & Pwr.	5s 1953	92	90½	95½
Houston Ltg. & Pwr.	5½s 1954	99½	97	101½
Hydraulic Pwr.	5s 1951	101	99½	102
Hydraulic Pwr.	5s 1950	101	100	103
Idaho Pwr.	5s 1947	96½	93	97½
Ill. Elec. Pwr.	6s 1943	102	99½	103½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco. fBid, low, high, Tuesday, Nov. 17. gBid, low, high Wednesday, Nov. 18. kLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies			Bid Price Saturday, Nov. 14	Low 1925	High 1925
BONDS (Continued)					
Ill. Pwr.	5s	1933	93⅛	93	95⅛
Ill. Pwr. & Lt.	6s	1953	101	100⅛	102
Ill. Pwr. & Lt.	7s	1953	102⅛	99	102⅛
Ind. Elec.	6s	1947	98	97	99⅛
Ind. Gen. Serv.	5s	1948	95	92	97⅛
Ind. Lighting	4s	1958	80⅛	78	83
Indiana & Mich. Elec.	5s	1957	98⅛	97⅛	99⅛
Indiana & Mich. Elec.	5s	1955	95	95	98
Ind. Pwr.	7⅛	1941	k105⅛	104	106
Ind. Service	5s	1950	89⅛	86⅛	92
Ind. Service	6s	2020	85	73	88⅛
Ingersoll-Rand	5s	1935	99⅛	92	99⅛
Interstate Elec.	6s	1933	95	95	99⅛
Interstate Pwr.	6s	1944	97⅛	95	99⅛
Interstate Pwr.	7s	1934	99⅛	97	100⅛
Interstate Pub. Serv.	6s	1948	98	96	100⅛
Iowa Ry. & Lt.	5s	1932	97⅛	97	99⅛
Jersey Cent. Pwr. & Lt.	5⅛	1945	95⅛	95	98
Kansas City Pwr. & Lt.	5s	1952	100	95⅛	102
Kansas Elec. Pwr.	6s	1937	100	97⅛	102
Kansas Elec. Pwr.	6s	1943	100	97⅛	102
Kansas Gas & Elec.	6s	1952	102⅛	98⅛	103⅛
Kansas Gas & Elec.	6s	2022	91⅛	86⅛	94⅛
Kentucky Utilities	6s	1949	100⅛	97	101⅛
Kings County Elec. Lt. & Pwr.	5s	1937	102⅛	99	103
Kings County Elec. Lt. & Pwr.	6s	1997	119⅛	114⅛	120⅛
Kings County Ltg.	5s	1954	98⅛	89	101⅛
Kings County Ltg.	6⅛	1954	107	103⅛	108⅛
Knoxville Ry. & Lt.	5s	1946	93	88	95⅛
Laclede Gas Lt.	5s	1934	100	98⅛	101⅛
Laclede Gas Lt.	5⅛	1953	100⅛	95⅛	102
Laurentian Pwr.	6s	1936	100	96	100⅛
Laurentide Pwr.	6s	1936	k99	96	100
Laurentide Pwr.	5s	1946	99⅛	97	100⅛
Laurentide Pwr.	6s	1936	k99	....	....
Lehigh Pwr. Sec. (notes)	6s	1927	101⅛	100⅛	101⅛
Lincoln Gas & Elec.	5s	1941	91	92⅛	95⅛
Long Island Ltg.	5s	1936	99⅛	98⅛	100⅛
Long Island Ltg.	6s	1954	100	99⅛	102
Long Island Ltg.	6s	1948	104⅛	102	105⅛
Long Island Ltg.	6s	1954	100⅛	99⅛	102
Los Angeles Gas & Elec.	5s	1939	99	98	101⅛
Los Angeles Gas & Elec.	5⅛	1943	98	94	99⅛
Los Angeles Gas & Elec.	5⅛	1947	98	96	99⅛
Los Angeles Gas & Elec.	5⅛	1949	97⅛	95⅛	99⅛
Los Angeles Gas & Elec.	6s	1942	102⅛	101⅛	104⅛
Louisiana Pwr.	6s	1944	97⅛	97	99
Louisville Gas & Elec.	5s	1952	97⅛	90⅛	99⅛
Louisville Gas & Elec.	5⅛	1954	101⅛	99	102
Lower Austrian Hydro Elec.	6⅛	1944	85⅛	85⅛	86⅛
Luzerne County Gas & Elec.	5s	1948	98	97	99⅛
Luzerne County Gas & Elec.	7s	1944	103	99⅛	104⅛
Luzerne County Gas & Elec.	6s	1954	102⅛	99	105
Madison River Pwr.	5s	1935	100	99⅛	101
Manila Elec.	7s	1942	101⅛	97⅛	102⅛
Manila Elec. Ry. & Ltg.	5s	1953	89	85	92
Manitoba Pwr.	7s	1941	102⅞	98⅛	104⅛
Memphis Pwr. & Lt.	5s	1948	98⅛	95	99⅛
Metropolitan Edison	6s	1952	104	101⅛	106
Metropolitan Edison	5s	1953	95⅛	91⅛	97
Metropolitan Pwr.	6s	1953	102	100	104
Michigan Lt.	5s	1946	98	97⅛	100
Michigan No. Pwr.	5s	1941	96	95⅛	97
Milwaukee Elec. Ry. & Lt.	5s	1926	100	99⅛	101⅛
Milwaukee Elec. Ry. & Lt.	4⅛	1931	96⅛	94⅞	97
Milwaukee Elec. Ry. & Lt.	5s	1951	98	94	100
Milwaukee Elec. Ry. & Lt.	5s	1961	89	84⅛	92⅛
Milwaukee Elec. Ry. & Lt.	6s	1953	100⅛	98⅛	104
Minn. Pwr. & Lt.	5s	1955	95	95	97
Minn. Pwr. & Lt.	6s	1950	103⅛	101⅛	105⅛
Miss. River Pwr.	5s	1951	99	96⅛	100⅛
Miss. River Pwr.	7s	1935	102	102	104
Mo. Edison Elec.	5s	1927	k100	100	100⅛
Mobile Elec.	5s	1946	96	91	97⅛
Montana Pwr.	5s	1943	100⅛	97⅛	100⅛
Montgomery Lt. & Wtr. Pwr.	5s	1943	k 93	86⅛	93⅛
Montreal Lt., Ht. & Pwr.	4⅛	1932	97	97	98⅛
Montreal Lt., Ht. & Pwr.	5s	1933	98⅛	98⅛	101
Montreal Pub. Serv.	5s	1942	94⅛	89	94⅛
Mountain States Pwr.	6s	1938	98⅛	96⅛	100⅛
Nashville Ry. & Lt.	5s	1953	97	94	98
Nashville Ry. & Lt.	5s	1958	89⅛	84	88⅛
Nassau Lt. & Pwr.	5s	1927	99⅛	98	101
Nassau & Suffolk Ltg.	5s	1945	89	82	91
National Pwr. & Lt.	7s	1972	102	97	104⅛
National Pub. Serv.	6⅛	1955	94⅛	94	96⅛
Nebraska Pwr.	5s	1949	99⅛	97	100
Nebraska Pwr.	6s	2022	97	89⅛	96⅛
Nevada-Calif. Elec.	6s	1946	99	96⅛	100⅛
Nevada-Calif. Elec.	6s	1950	99	96⅛	100⅛
New England Pwr.	5s	1951	101	100⅛	103
New Jersey Pwr. & Lt.	5s	1936	96	92⅛	97⅛
New Orleans Pub. Serv.	4⅛	1935	86⅛	83⅛	88⅛
New Orleans Pub. Serv.	5s	1952	91	90	92
New Orleans Pub. Serv.	5s	1955	89⅛	88⅛	92⅛
New Orleans Pub. Serv.	6s	1949	92	86⅛	93⅛
N. Y. & Queens Elec. Lt. & Pwr.	5s	1930	100	99⅛	101
N. Y. & Westchester Ltg.	4s	2004	78	76	81
N. Y. & Westchester Ltg.	5s	1954	96	93	97
New York Edison	6⅛	1941	114⅛	112	115⅛
New York Edison	5s	1944	101	99⅛	102
N. Y. Gas & Elec. Lt., Ht. & Pwr.	5s	1948	103⅛	100⅛	104⅛
N. Y. Gas & Elec. Lt., Ht. & Pwr.	4s	1949	88⅛	86	90⅛
N. Y. State Gas & Elec.	5⅛	1962	100⅛	96	101⅛
Newport News & Hampton Ry., Gas & Elec.	5s	1944	88	84	93
Niagara Falls Pwr.	5s	1932	102	100	103
Niagara Falls Pwr.	6s	1932	106	103⅛	106⅛
Niagara Falls Pwr.	6s	1950	104⅛	105⅛	106⅛
Niagara, Lock. & Ont. Pwr.	5s	1954	k98⅛	104⅛	110
Niagara, Lock. & Ont. Pwr.	5s	1955	99	97⅛	100
Niagara, Lock. & Ont. Pwr.	6s	1958	k109⅛	104⅛	110⅛
Norfolk Ry. & Lt.	5s	1949	94	93	95⅛
No. Amer. Edison	6s	1952	102⅛	96⅛	102⅛
No. Amer. Edison	6⅛	1948	104⅛	100⅛	106
No. Amer. Lt. & Pwr.	7s	1954	99⅛	97	100
North Caro. Pub. Serv.	5s	1934	90	89	93⅛
North Caro. Pub. Serv.	6s	1954	94	91⅛	96
North Caro. Pub. Serv.	6⅛	1944	98	96	100
North Shore Elec.	5s	1940	99⅛	97⅛	100
No. Calif. Pwr.	5s	1948	99	98⅛	100⅛
No. Ind. Gas & Elec.	5s	1929	99	97	100⅛
No. Ind. Gas & Elec.	6s	1952	102	99⅛	103⅛
Northern N. Y. Utilities	5⅛	1949	99	96⅛	100
No. Ohio Trac. & Lt.	4s	1933	86	82	87⅛
No. Ohio Trac. & Lt.	5s	1956	81	78	87
No. Ohio Trac. & Lt.	6s	1926	98⅛	98⅛	100
No. Ohio Trac. & Lt.	6s	1947	95	91	97
No. Ontario Lt. & Pwr.	6s	1931	98⅛	95⅛	99⅛
No. States Pwr.	6⅛	1933	135	105⅛	136⅛
No. States Pwr. (notes)	6⅛	1933	103⅛	99⅛	104⅛
No. States Pwr.	6s	1948	102⅛	101	104⅛
No. States Pwr.	6s	1941	105	103	107
No. States Pwr.	5s	1941	97⅛	93	99⅛
No. Tex. Elec.	5s	1940	65	80⅛	82
Northwestern Elec.	6s	1935	101	101⅛	102⅛
Northwestern Pub. Serv.	6⅛	1948	99	97⅛	100⅛
Ohio Pwr.	5s	1952	93⅛	89⅛	96
Ohio Pwr.	6s	1953	102⅛	101	104⅛
Ohio Pwr.	6s	2024	95	88⅛	95⅛
Ohio Pwr.	7s	1951	106	106⅛	107⅛
Ohio Pub. Serv.	5s	1954	91	87	93
Ohio Pub. Serv.	6s	1953	100⅛	98	101⅛
Ohio Pub. Serv.	7⅛	1946	111⅛	108	112⅛
Ohio Pub. Serv.	7s	1947	111⅛	107⅛	111⅛
Ohio River Edison	6s	1948	102⅛	98⅛	104
Okla. Gas & Elec.	5s	1950	92	93⅛	96
Okla. Gas & Elec.	6s	1940	96⅛	96	98⅛
Ontario Pwr. of Niagara Falls	5s	1943	99⅛	98	100⅛
Ontario Transmission	5s	1945	99⅛	97	99⅛
Ozark Pwr. & Wtr.	5s	1952	76	75	81
Pacific Coast Pwr.	5s	1940	99⅛	97⅛	99⅛
Pacific Gas & Elec.	5s	1942	97⅛	93⅛	99
Pacific Gas & Elec.	5s	1955	k 93⅛	94	95⅛
Pacific Gas & Elec.	5⅛	1952	101⅛	97⅛	102⅛
Pacific Gas & Elec.	6s	1941	105⅛	103⅛	106
Pacific Lt. & Pwr.	5s	1951	99⅛	98⅛	100⅛
Pacific Lt. & Pwr.	5s	1942	99⅛	98	101⅛
Pacific Pwr. & Lt.	5s	1930	99⅛	98	100
Pacific Pwr. & Lt.	5s	1953	k 96⅛	....	....
Parr Shoals Pwr.	5s	1952	94	92⅛	97
Paterson & Passaic Gas & Elec.	5s	1949	99⅛	96	100⅛
Penn Central Lt. & Pwr.	6s	1953	103	102	104⅛
Penn Edison	5s	1946	96⅛	94	97
Penn Elec.	6⅛	1954	98⅛	96	99⅛
Penn. Elec.	6s	1955	93⅛	93⅛	95
Penn Ohio Elec.	6⅛	1938	104⅛	99⅛	105
Penn Ohio Pwr. & Lt.	5⅛	1954	97⅛	95	99⅛
Penn Ohio Pwr. & Lt.	6s	1939	97⅛	94	99
Penn Pwr. & Lt.	5s	1952	97	95	98⅛
Penn Pwr. & Lt.	5s	1953	97⅛	95	98⅛
Penn Pwr. & Lt.	6s	1953	104⅛	102⅛	105⅛
Penn Pwr. & Lt.	7s	1951	106	106	107⅛
Penn Pub. Serv.	5s	1954	95	93	96⅛
Penn Pub. Serv.	6s	1947	103	103	105⅛
Penn Wtr. & Pwr.	5s	1940	101⅛	99⅛	102⅛
Penn Wtr. & Pwr.	5⅛	1953	102	99⅛	103
Phila. Co.	6s	1944	103⅛	101⅛	105
Phila. Co.	5⅛	1938	98⅛	93⅛	100
Phila. Co.	5s	1951	94	95	97
Phila. Co.	5s	1949	k102	94⅛	104⅛
Phila. Elec.	6s	1941	c107⅛	106	108⅛
Phila. Elec.	5s	1966	c101	100	104⅛
Phila Elec.	4s	1966	c 85	83	85
Phila. Elec.	5s	1960	c101	100	104
Phila. Elec.	5⅛	1947	c106⅛	103⅛	107
Phila. Elec.	5⅛	1953	c106⅛	104⅛	107⅛
Portland Elec. Pwr.	6s	1947	98⅛	96⅛	100⅛
Portland Gen. Elec.	5s	1935	99⅛	98⅛	100⅛
Portland Ry., Lt. & Pwr.	5s	1942	88⅛	84⅛	92
Portland Ry., Lt. & Pwr.	6s	1947	98	94	100⅛
Portland Ry., Lt. & Pwr.	7⅛	1946	105⅛	104⅛	108
Potomac Edison	6s	1949	98⅛	96	100
Potomac Edison	6⅛	1948	102	99	103⅛
Potomac Elec. Pwr.	5s	1929	99⅛	99	100⅛
Potomac Elec. Pwr.	5s	1936	99⅛	98⅛	100
Power Corp. of N. Y.	6s	1942	99⅛	97⅛	101
Power Corp. of N. Y.	6⅛	1942	104	99⅛	103⅛
Power Securities	6s	1949	f79	....	....
Pub. Lt. & Pwr.	5s	1945	70	64	79
Pub. Serv. Co. of Colo.	5⅛	1954	93⅛	92	96⅛
Pub. Serv. Co. of Colo.	6s	1953	99	98	101
Pub. Serv. Co. of Colo.	7s	1933	101	98⅛	102⅛
Pub. Serv. Corp. of N. J.	5s	1959	104⅛	103⅛	105⅛
Pub. Serv. Corp. of N. J.	6s	1944	99⅛	95	100
Pub. Serv. Co. of No. Ill.	5s	1956	96	91	97⅛
Pub. Serv. Co. of No. Ill.	5⅛	1962	101	96⅛	102⅛
Pub. Serv. Co. of No. Ill.	5⅛	1964	101	96⅛	102⅛
Pub. Serv. Co. of Okla.	6s	1949	99	97⅛	103
Pub. Serv. Elec. & Gas.	5⅛	1959	103⅛	98⅛	105⅛
Pub. Serv. Elec. & Gas.	5⅛	1964	103⅛	99⅛	105
Public Utilities, (Evansville, Ind.)	6s	1929	100⅛	99	101
Puget Sound Pwr.	5s	1933	98	98⅛	100⅛
Puget Sound Pwr. & Lt.	5⅛	1949	99	96⅛	100⅛
Quebec Pwr.	6s	1953	104⅛	98⅛	102⅛
Queensborough Gas & Elec.	5s	1952	99	96⅛	100⅛
Queensborough Gas & Elec.	6s	1953	104⅛	101	105
Rhine-Westphalia Electric Power	7s	1950	94⅛	94⅛	94⅛
Rio de Janeiro Tram., Lt. & Pwr.	5s	1935	92⅛	85	91⅛
Robbins & Myers	7s	1952	60	57⅛	73⅛
Rochester Gas & Elec.	5⅛	1948	103⅛	102	104⅛
Rochester Gas & Elec.	7s	1946	110⅛	109⅛	111
Rockford Elec.	5s	1939	99⅛	98	101
St. Joseph Ry., Lt., Ht. & Pwr.	5s	1937	85⅛	85⅛	93
St. Paul Gas Lt.	5s	1944	100⅛	98⅛	100⅛
St. Paul Gas Lt.	5⅛	1954	101⅛	98	102⅛
Salt River Valley Wtr.	6s	1938	f100	....	....
Salmon River Pwr.	5s	1952	100⅛	98⅛	101⅛
San Antonio Gas & Elec.	5s	1949	97	96	98⅛
San Antonio Pub. Serv.	6s	1952	101⅛	99⅛	104
San Diego Cons. Gas & Elec.	5s	1939	100	98	101
San Diego Cons. Gas & Elec.	6s	1939	101⅛	99	103
San Joaquin Lt. & Pwr.	5s	1945	98⅛	98	100
San Joaquin Lt. & Pwr.	6s	1950	102⅛	101	103⅛
San Joaquin Lt. & Pwr.	6s	1952	101	99⅛	103⅛
San Joaquin Lt. & Pwr.	6s	1954	100⅛	99	101
Sunda Falls	5s	1955	98	98	98
Savannah Elec. & Pwr.	7⅛	1941	f104⅛	....	....
Saxon Pub. Wks. (Germany)	7s	1945	94	90⅛	94⅛
Scranton Electric	5s	1937	101⅛	99⅛	101⅛
Seattle Elec.	5s	1930	99⅛	99⅛	101
Seattle Elec.	5s	1929	100	99	100⅛
Seattle Elec.	5s	1939	92⅛	90	93⅛
Seattle Ltg.	5s	1949	91⅛	85⅛	92
Shawinigan Wtr. & Pwr.	5s	1934	100	100	101⅛
Shawinigan Wtr. & Pwr.	5⅛	1950	103⅛	101⅛	104
Shawinigan Wtr. & Pwr.	6s	1950	105	104	106⅛
Siemens & Halske	7s	1928	96⅛	92⅛	99⅛
Siemens & Halske	7s	1935	95⅛	90⅛	96⅛
Sierra & San Francisco Pwr.	5s	1949	77⅛	75	80
Sierra & San Francisco Pwr.	6s	1949	89	87	93⅛
Sioux City Gas & Elec.	6s	1947	101⅛	99	102
Sioux City Gas & Elec.	6s	1949	101⅛	99	102
So. Caro. Gas & Elec.	6s	1942	84	87	93
So. Caro. Gas & Elec.	6s	1932	75	83	88
Southeast Pwr. & Lt.	6s	2025	91	88	91⅛
So. Cal. Edison	5s	1939	99⅛	99⅛	101⅛
So. Cal. Edison	5s	1944	95	92⅛	96
So. Cal. Edison	5⅛	1944	101⅛	98⅛	102
So. Cal. Edison	6s	1943	102⅛	100⅛	104⅛
So. Cal. Edison	6s	1944	104⅛	102⅛	105⅛
So. Cities Utilities	5s	1931	99	99	102
Southern Colo. Power	6s	1947	98⅛	93⅛	99⅛
So. Public Utilities	5s	1943	99⅛	97⅛	100
So. Sierras Pwr.	6s	1936	102⅛	102	104⅛
So. Utilities	6s	1933	102	97⅛	102⅛
So. Wisconsin Pwr.	5s	1938	90	88	93
Southwestern Gas & Elec.	5s	1932	96⅛	94	98
Southwestern Gas & Elec.	6s	1957	96⅛	89	97⅛
Southwestern Pwr. & Lt.	5s	1943	94⅛	90	97
Southwestern Pwr. & Lt.	6s	2022	93	88⅛	94⅛
Southwestern Utilities	8s	1936	97	96	102
Springfield Ry. & Lt.	5s	1926	99⅛	98⅛	100⅛
Standard Elec. of Cal.	5s	1939	98⅛	98⅛	100⅛
Standard Gas & Elec.	6s	1935	99⅛	91	101
Staten Island Edison	6⅛	1953	104⅛	104	106⅛
Syracuse Ltg.	5s	1951	100	97⅛	101⅛
Syracuse Ltg.	5⅛	1954	102	100⅛	103
Tampa Elec.	5s	1933	f99	....	....
Tenn. Elec. Pwr.	6s	1947	102⅛	99⅛	104⅛
Tenn. Pwr.	5s	1962	94⅛	90	96⅛
Tex. Pwr. & Lt.	5s	1937	98	97	99⅛
Tex. Pwr. & Lt.	6s	2022	97⅛	90	96⅛
Tide Water Pwr.	6s	1942	99⅛	98⅛	101
Tide Water Pwr.	7s	1937	98⅛	97⅛	101⅛
Toho Elec. Pwr. (Japan)	7s	1955	104	87	91⅛
Tokyo Elec. (Japan)	6s	1928	99	98⅛	99⅛
Toledo Edison	5s	1947	98⅛	97	100
Toledo Edison	7s	1941	109⅛	108⅛	110
Toledo Gas Elec. & Htg.	5s	1935	96⅛	97⅛	100⅛
Toledo Trac., Lt. & Pr. notes	5⅛	1930	97⅛	97⅛	100⅛
Topeka Edison	5s	1930	98⅛	97	100
Topeka Ry. & Lt.	5s	1933	95⅛	90⅛	96⅛
Trenton Gas & Elec.	5s	1949	99⅛	98	100
Tri-City Ry. & Lt.	5s	1930	98⅛	96⅛	99⅛
Twin State Gas & Elec.	5s	1953	92⅛	84	94⅛
Tyrol Hydro-Elec. Pwr.	7⅛	1955	96⅛	94⅛	97
Union Elec. Lt. & Pwr.	5s	1932	100⅛	99⅛	102
Union Elec. Lt. & Pwr.	5s	1933	99⅛	98⅛	101
Union Elec. Lt. & Pwr.	5s	1954	98⅛	97⅛	100
Union Elec. Lt. & Pwr.	5⅛	1954	102	100	104
United Elec. of N. J.	4s	1949	87⅛	85	88⅛
United Elec. Lt. & Pwr.	4⅛	1929	k 98⅛	98⅛	99
United Gas & Elec.	6s	1945	99	96	101
United Lt. & Pwr. notes	5⅛	1928	99⅛	98	100
United Lt. & Pwr.	5⅛	1959	93⅛	89⅛	97⅛
United Lt. & Pwr.	6⅛	1974	95⅛	92⅛	97⅛
United Lt. & Rys.	5s	1932	95⅛	93	97⅛
United Lt. & Rys.	6s	1926	99	100	101⅛
United Lt. & Rys.	6s	1952	98⅛	95⅛	100⅛
United Lt. & Rys.	6s	1973	89	87	92
United Pwr. & Lt.	6s	1944	101⅛	99	103
Utah Lt. & Trac.	5s	1944	87⅛	83⅛	91⅛
Utah Pwr. & Lt.	5s	1944	87⅛	91	98⅛
Utah Pwr. & Lt.	6s	1944	102⅛	102	104⅛
Utah Pwr. & Lt.	6s	2022	92⅛	88⅛	94⅛
Utica Elec. Lt. & Pwr.	5s	1950	101⅛	100⅛	102
Utica Gas & Elec.	5s	1957	101⅛	98⅛	103
Vermont Hydro-Elec.	6s	1929	100	98⅛	100⅛
Vicksburg Lt. & Trac.	5s	1932	91	89	93⅛
Virginian Pwr.	5s	1942	93⅛	88	96
Virginian Pwr.	6⅛	1954	101⅛	99	102⅛
Virginia Ry. & Pwr.	5s	1943	97⅛	93⅛	99
Wagner Elec. Mfg.	7s	....	k101⅛	100	102
Washington Coast Util.	6s	1941	101⅛	99⅛	101⅛
Washington Wtr. Pwr.	5s	1939	101⅛	99⅛	101⅛
West Penn Pwr.	5s	1963	99⅛	93⅛	99⅛
West Penn Pwr.	5s	1946	99	93	100
West Penn Pwr.	5⅛	1953	103⅛	100⅛	105⅛
West Penn Pwr.	7s	1946	107⅛	104⅛	107⅛
West Virginia Lt., Ht. & Pwr.	6s	1929	100	95	100
West Virginia Utilities	6s	1935	95⅛	91	98
Westchester Ltg.	5s	1950	101⅛	98	102
Western Elec.	5s	1944	100⅛	98	101⅛
Western N. Y. Utilities	5s	1946	96⅛	90⅛	97⅛
Western Pwr.	6⅛	1954	100	....	100⅛
West. States Gas & Elec.	5s	1941	97⅛	95	99⅛
West. States Gas & Elec.	6s	1947	99	97	100⅛
Westinghouse Elec. & Mfg.	7s	1931	106⅛	105⅛	108⅛
Wisconsin Elec. Pwr.	5s	1954	98⅛	93⅛	99
Wisconsin Gas & Elec.	5s	1952	99	97	100⅛
Wis.-Minn. Lt. & Pwr.	5s	1944	95⅛	93	96⅛
Wis. Ry., Lt. & Pwr.	5s	1933	92⅛	87⅛	93
Wis. River Pwr.	5s	1941	90⅛	88	92
Yadkin River Pwr.	5s	1941	98⅛	96⅛	99⅛
Yarmouth Lt. & Pwr.	5s	1937	83	82	87
Yarmouth Lt. & Pwr.	8s	1951	98	97	102

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco. *i*Bid, low, high, Tuesday, Nov. 17. *j*Bid, low, high, Wednesday, Nov. 18. *k*Latest quotations available.

Business Facts for Electrical Men

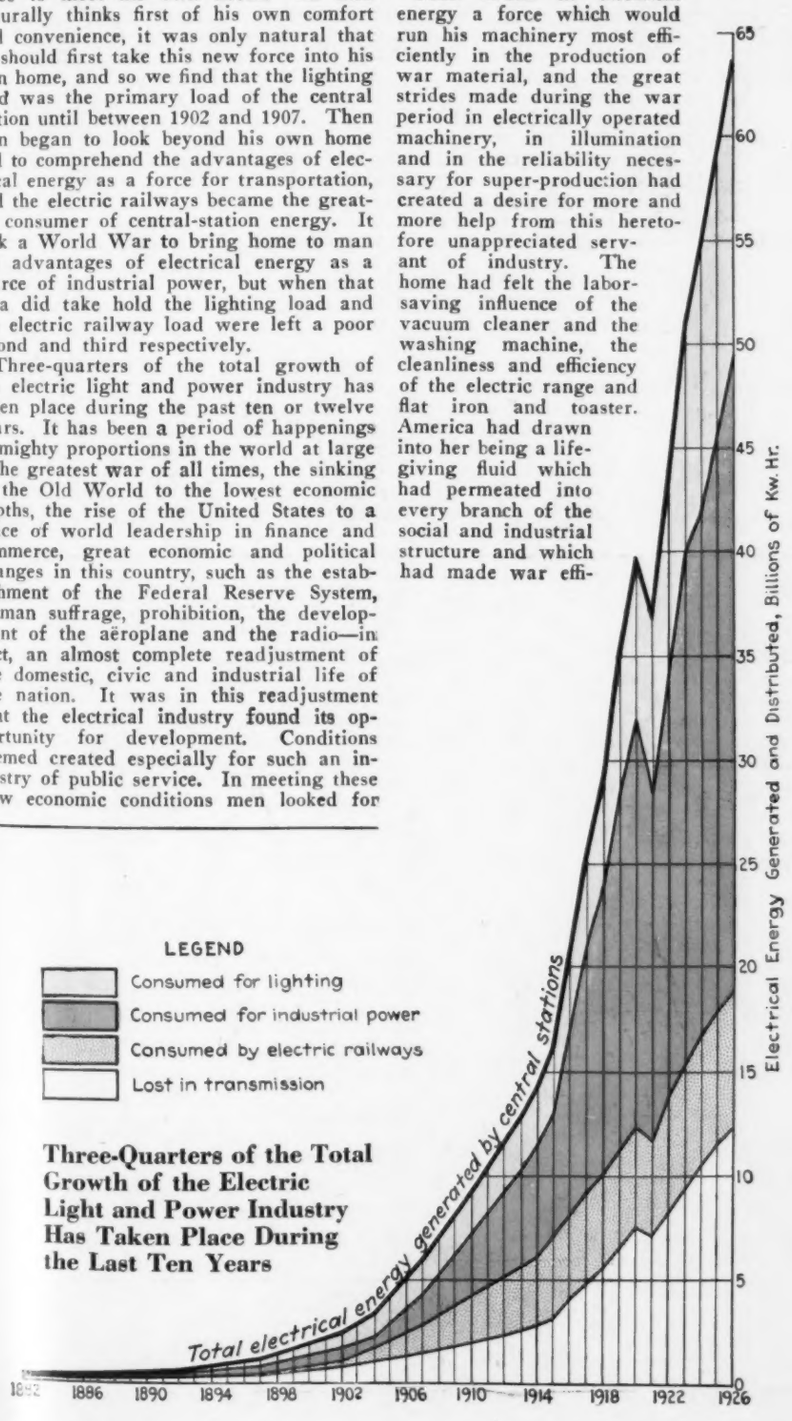
Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Evolution of the Central Station Load

THE growth structure or family tree of the central-station industry is not complicated. It is but the result of man's gradual and orderly application of a great force to meet his own needs. As man naturally thinks first of his own comfort and convenience, it was only natural that he should first take this new force into his own home, and so we find that the lighting load was the primary load of the central station until between 1902 and 1907. Then man began to look beyond his own home and to comprehend the advantages of electrical energy as a force for transportation, and the electric railways became the greatest consumer of central-station energy. It took a World War to bring home to man the advantages of electrical energy as a source of industrial power, but when that idea did take hold the lighting load and the electric railway load were left a poor second and third respectively.

Three-quarters of the total growth of the electric light and power industry has taken place during the past ten or twelve years. It has been a period of happenings of mighty proportions in the world at large—the greatest war of all times, the sinking of the Old World to the lowest economic depths, the rise of the United States to a place of world leadership in finance and commerce, great economic and political changes in this country, such as the establishment of the Federal Reserve System, woman suffrage, prohibition, the development of the aëroplane and the radio—in fact, an almost complete readjustment of the domestic, civic and industrial life of the nation. It was in this readjustment that the electrical industry found its opportunity for development. Conditions seemed created especially for such an industry of public service. In meeting these new economic conditions men looked for some force or new panacea which would raise life to a higher plane, even as man has striven since the beginning of time to lift himself to a higher type of living.

Man found in electrical energy a force which would run his machinery most efficiently in the production of war material, and the great strides made during the war period in electrically operated machinery, in illumination and in the reliability necessary for super-production had created a desire for more and more help from this heretofore unappreciated servant of industry. The home had felt the labor-saving influence of the vacuum cleaner and the washing machine, the cleanliness and efficiency of the electric range and flat iron and toaster. America had drawn into her being a life-giving fluid which had permeated into every branch of the social and industrial structure and which had made war efficiency and economy a permanent condition in the industrial and home life of the country. It may be truly stated that as the result of the proficiency displayed by the electric light and power companies in meeting war conditions the industry really entered into its own at the close of the war and with the opening of the post-war decade.



Three-Quarters of the Total Growth of the Electric Light and Power Industry Has Taken Place During the Last Ten Years

Up to the present time the development of the domestic load has been largely along the line of illumination and the power load has been one of motors. All trends seem to indicate that the future will witness a material change in the central-station load. The wiping out of the housing shortage and the elimination to a large extent of the unwired old houses within the reach of central-station lines mean a material drop in the number of new high-revenue domestic customers taken on the lines in the years to come. The central-station must, therefore, turn to the more intensive study of materially increasing the consumption per domestic customer. The refrigerator, clothes washer, range, ironer, vacuum cleaner, etc., better illumination of the home, the placing of radio receiving sets on the central-station lines, all point the way along which the industry must proceed in the future. The domestic load will become more and more a small power load as the housewife becomes better educated to the uses of labor-saving devices in the home.

Likewise, the industrial load will change in the future. Approximately 65 per cent of industry is now electrified. There are 622,000 industrial power customers at the present time, and it is doubtful whether the potential number of industrial power customers of all types exceeds 800,000. The central-station must, therefore, turn to the problem of increasing the energy consumption per industrial power customer even as it must also do with the domestic customer. Industrial heating and the use of energy in electrolytic and electrochemical processes hold the answer to this problem. It is estimated that today the industrial heating load totals only about 1,200,000 kw., while the potential heating load and related loads are estimated at 75,000,000 kw., or three times the present motor load.

It would appear that the electric light and power industry has come to a milestone in its progress and that the next period of its growth will involve many new problems in generation and distribution. The past has been one of adding new customers, the future will be more largely one of an intensive development of these customers toward a greater domestic, commercial and industrial use of electrical energy.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source or data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

The Activities of the Central-Station Industry in the North Central States

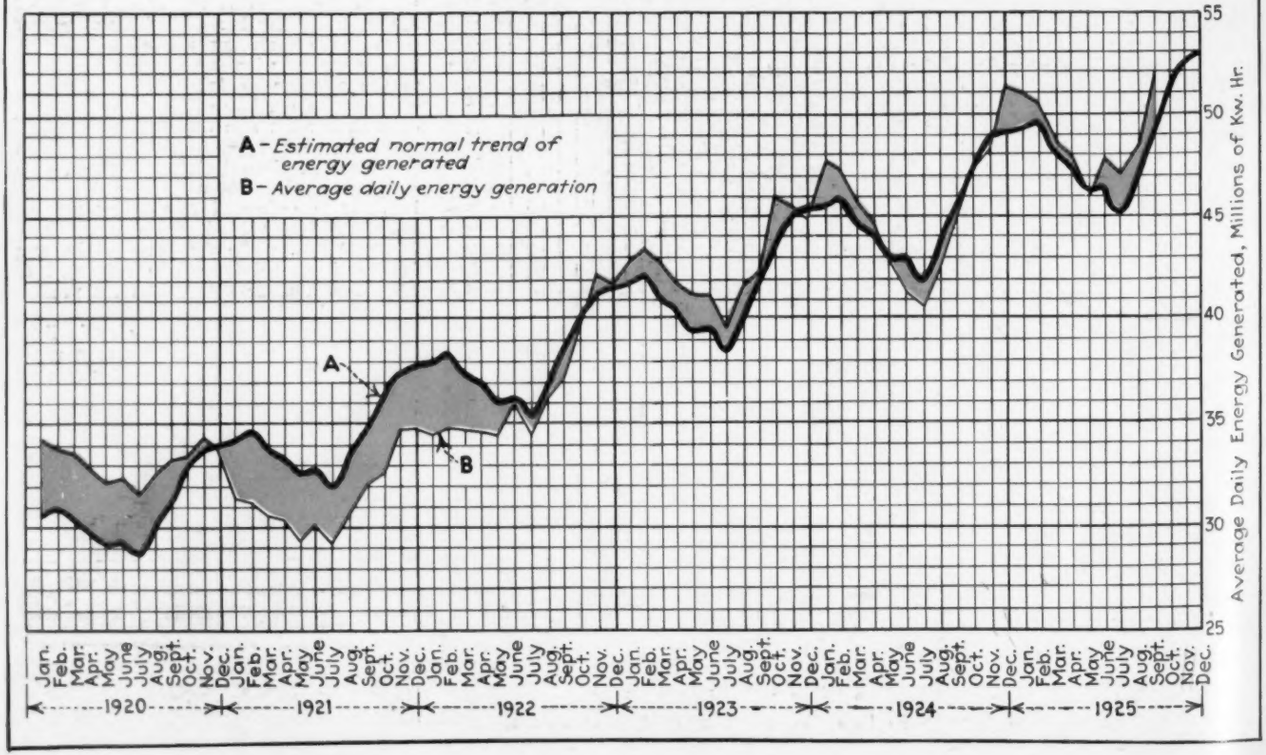
THE twelve states which compose the North Central section of the country contain within their boundaries the greatest concentrated load of the electric light and power industry. Almost one-third of the total energy generated in the country is generated by companies operating within these states. The industries of the section have almost one-third of the total installed primary horsepower of the nation, and about 38 per cent of the total number of central-station customers are to be found within these states. It is a region of large cities, large industrial enterprises, extensive mining and agricultural interests which involve over one-half of the cultivated lands of the nation.

The North Central States lead all other sections in the adoption of electrical energy into both their homes and their factories. Through the progressive policies of the companies operating in the several states of the section the domestic field has been highly developed as regards both illumination and the use of electrical appliances. The degree of industrial electrification, 64 per cent, exceeds that of any other section of the nation with the exception of the Mountain and Pacific States, and the leading state of the section, Illinois, is 72 per cent electrified industrially. Interconnection and "superpower" have been developed until today almost every transmission system of importance is interconnected with other systems, making for more reliable and efficient public service.

The operations of the central stations have shown a very consistent and stable growth. The material curtailment of power in 1921 and 1922 as the result of the industrial depression was soon overcome, and since that time the monthly operations have been very close to the estimated normal based upon operations during the previous five years. During 1925 the industry has been operating above the estimated normal except during May. In other words, the central-station industry in the North Central States is growing at a faster rate today than during the past five years taken as a whole.

Some idea of the progress made by the central-station industry in the North Central States is to be drawn from the fact that the energy generated has grown from 12,139,129,000 kw-hr. in 1920 to an estimated 18,014,000,000 kw.-hr. in 1925, value of plant and equipment from $1,150,000,000 to $1,982,000,000, gross revenue from $298,680,000 to $482,000,000, number of employees from 43,800 to 58,180, customers served from 3,845,000 to 5,395,450, rating of installed generators from 4,969,500 kva. to 9,300,000 kva., water-power development from 1,183,059 hp. to 1,289,590 hp., and during this six-year period the industry has spent a total of $875,000,000 for additions and extensions to its generation, transmission and distribution systems.

The close of the year finds all trends pointing unmistakably to even greater achievements in the year 1926.

Energy Generated by Central Stations of the North Central States

(100 per Cent of the Industry)